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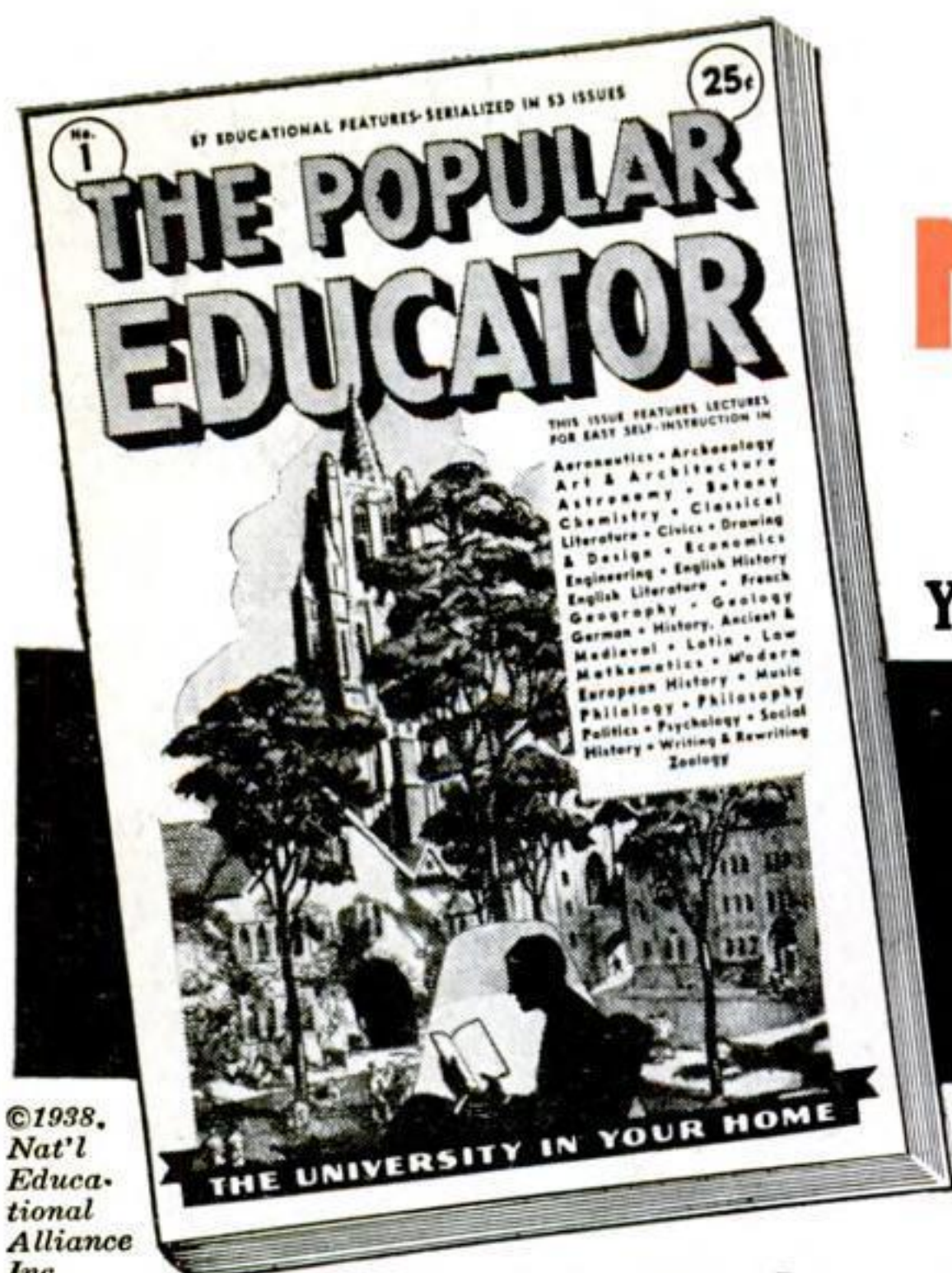
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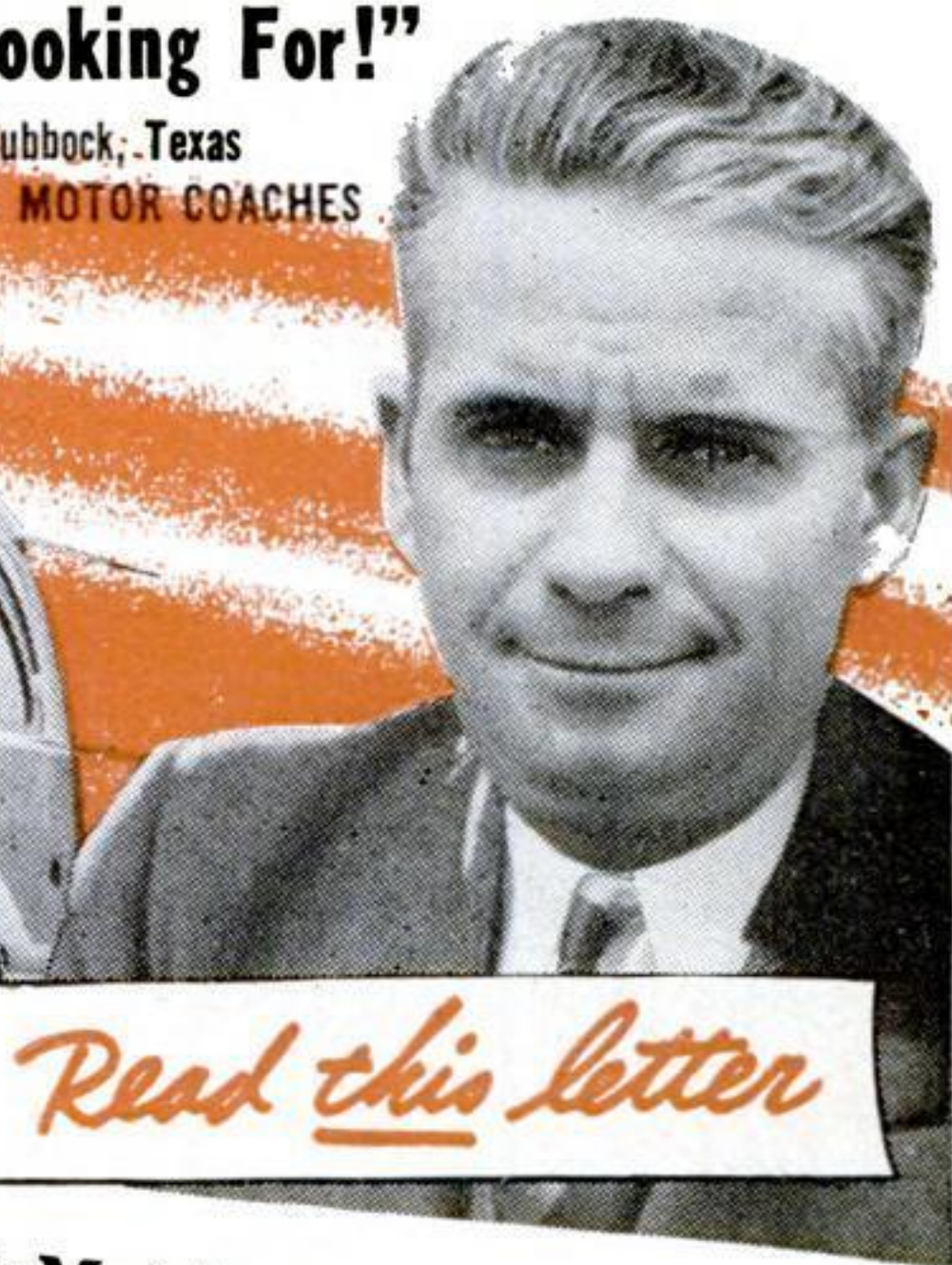
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Says G. C. McMakin, Lubbock, Texas
President, McMakin Motor Coaches



Read this letter

Motorists Everywhere Report Sensational New Type Spark Plugs Give Remarkable NEW PEP . . . POWER . . . AND GAS MILEAGE

To help you decide *which spark plugs to buy*, Auto-Lite shows you this unsolicited recommendation from G. C. McMakin, an official of two of the largest bus operating companies in the Southwest.

14,231 miles, at 664 miles a day on one set of the new Auto-Lites *without a failure!* And before he installed Auto-Lites, Mr. McMakin declares he was changing spark plugs every 2,000 miles.

Read the evidence in his letter. New Auto-Lite Spark Plugs, with Konium Electrode Geometric gap design and Ziramic Insulator, bring out the best in any motor. They pep up pickup, make starting easier, add top speed, stop gasoline waste, *last longer!*

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Millions of motorists are being told in dynamic advertising the benefits of this sensational new spark plug. Write The Electric Auto-Lite Co., Dept. P.S. 10, Toledo, Ohio, for details of the 1938 merchandising plan.

McMakin Motor Coaches

G. C. McMakin, President

Lubbock, Texas

Electric Auto-Lite Co.
Toledo, Ohio

May 6, 1938

Gentlemen,

April 2nd of this year we were persuaded to try a set of Auto-Lite spark plugs in a 16A, 28 passenger pug nose White Bus. We have been installing a new set of plugs every two thousand (2000) miles, due to plug failure. First one make and another I was interested to see myself just what you folks had.

This bus is on a regular run, Odessa, Lubbock and Vernon, and makes 664 miles a round trip every day. Auto-Lites were installed at 111,000 miles and May 4th, we had 125,231 miles on the speedometer. Other than cleaning and re-setting the gaps twice, we have done nothing, and they are still going strong.

We have some fifty pieces of equipment in the Fleet, Chevrolets, Whites, Internationals and Yellows, and with this service record are immediately swinging to Auto-Lite 100%.

Certainly we wish to thank the party responsible for suggesting this new plug, for it has cut our plug cost to a minimum and has given us better performance than we have ever had before.

It is a pleasure to endorse Auto-Lite spark plugs to anyone, as I feel you have what every one of us has been looking for.

Very truly yours,

Mc MAKIN MOTOR COACHES.

By *G. C. McMakin*
President

Ask for **AUTO-LITE**
SPARK PLUGS

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STOPS YOU QUICKER THAN YOU'VE EVER STOPPED BEFORE

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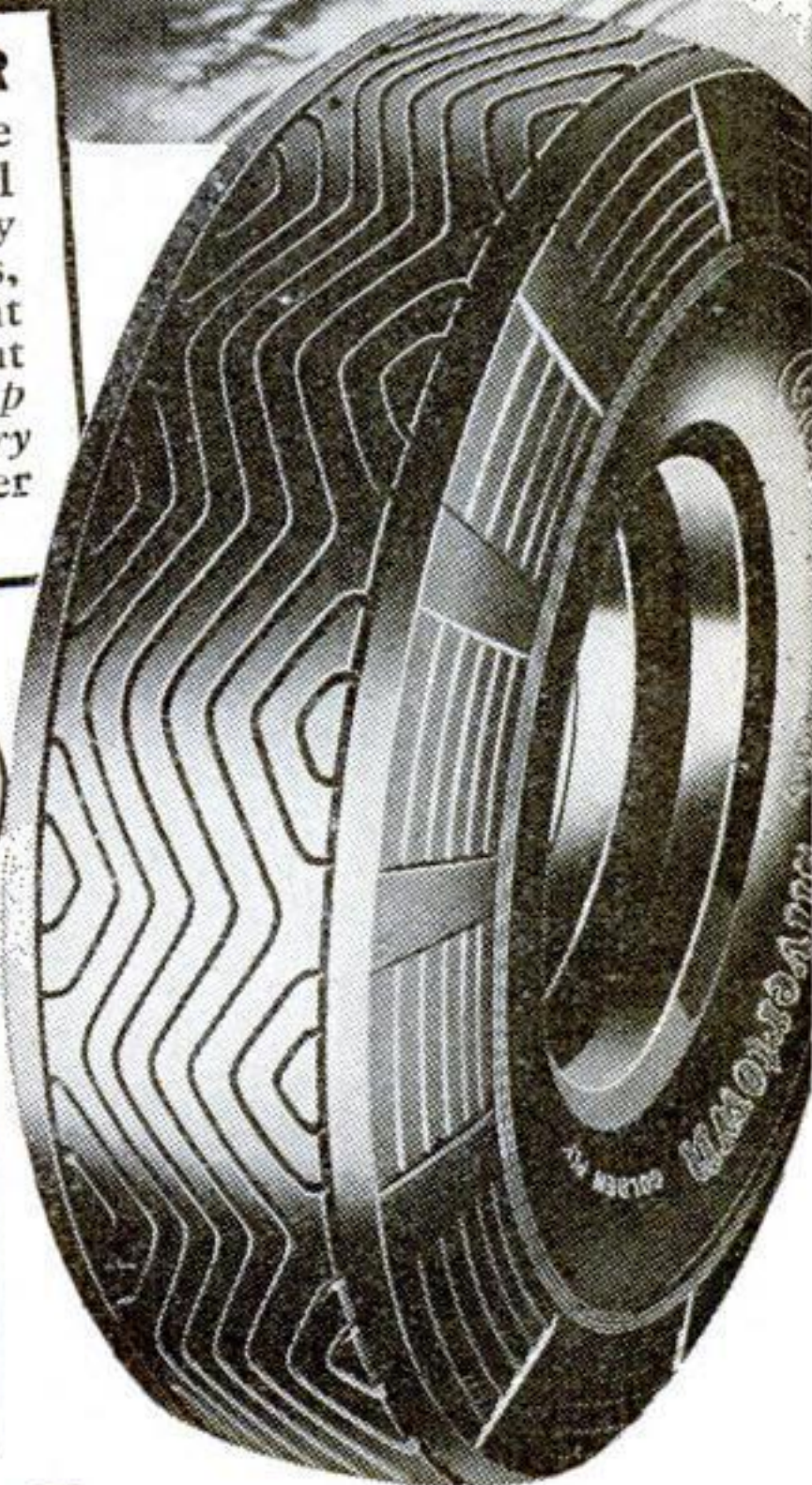
HOW LIFE-SAVER TREAD WORKS. The never-ending spiral bars act like a battery of windshield wipers, sweep the water right and left—force it out through the deep grooves—make a dry track for the rubber to grip.



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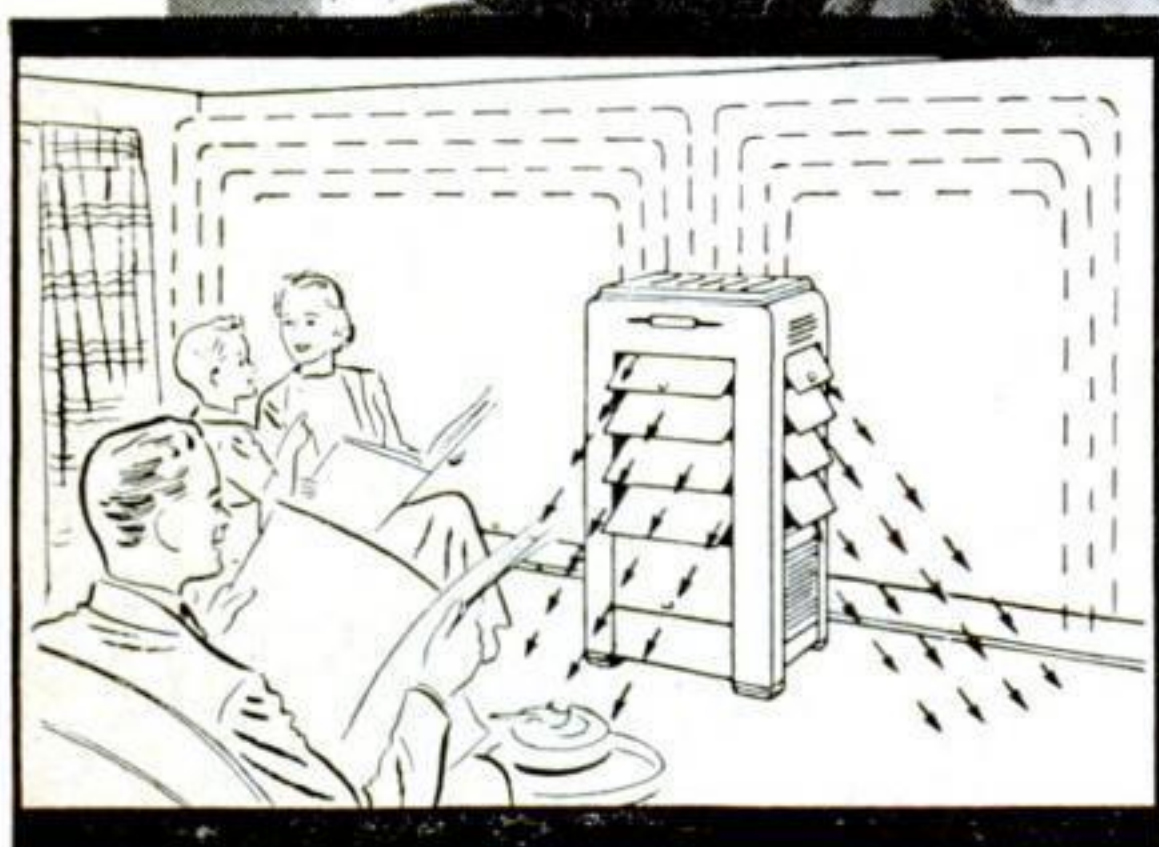


The new Goodrich SAFETY Silvertown

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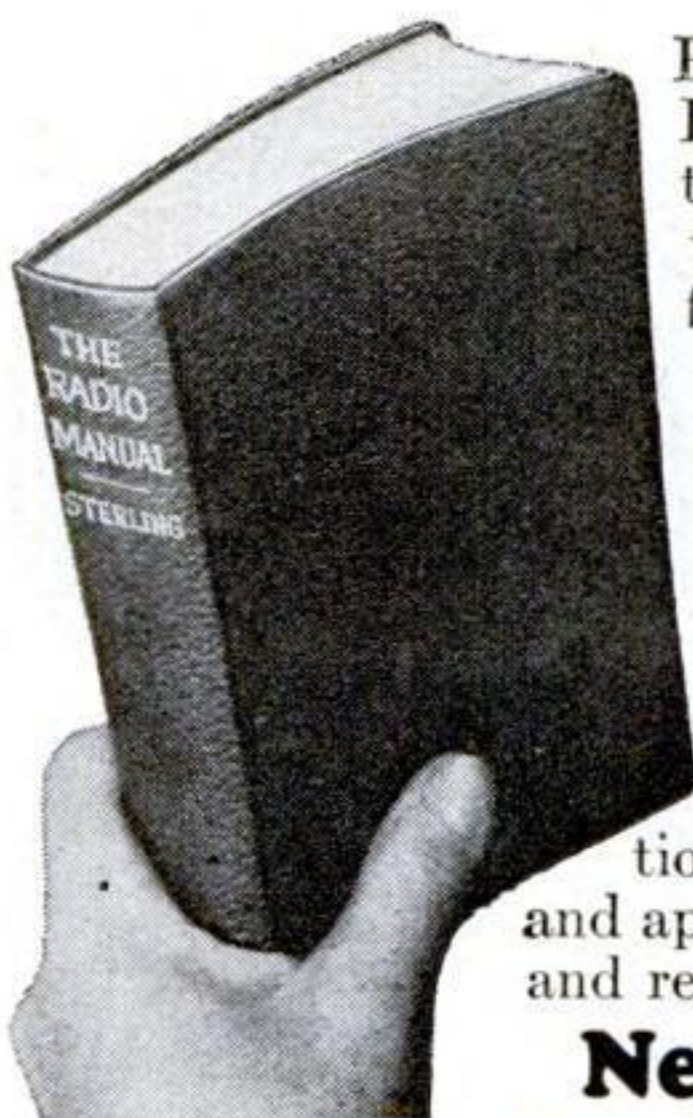
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HAD the 7½ million people who bought new radio sets in 1937 been obliged to pay 1929 prices for them, the total cost to the public would have been \$700,000,000 greater than it actually was. In fact, the 7½ million sets of 1937 cost the public \$188,000,000 less than the 4½ million sets of 1929. And because radios cost less, more people could buy them, and the purchasers had more money to buy additional comforts and conveniences.

This is but one of many cases where industry has found ways to make better products at less cost. For instance, the 1½ million electric washers bought in 1937 cost the purchasers 2 million dollars less than the million bought in 1929. The 1,200,000 electric fans bought in 1937 cost

the purchasers \$700,000 less than about half that number bought in 1929. And in this same period hundreds of other manufactured products, because of improved manufacturing methods, have been reduced in cost so that more people can have more of the good things of life.

This process of creating *real wealth* has brought to America the highest standard of living ever known, and it is this process which must continue if even higher standards are to be attained. General Electric scientists, engineers, and workmen are contributing to this progress. By developing new and better ways to use electricity for the benefit of the public, they are constantly providing More Goods for More People at Less Cost.

G-E research and engineering have saved the public from ten to one hundred dollars for every dollar they have earned for General Electric

GENERAL ELECTRIC

1938—OUR SIXTIETH YEAR OF MAKING ELECTRICITY MORE USEFUL TO YOU—1938



BUT
DAYDREAMS
DON'T PAY
BILLS!

Daydreams may build fine "castles in the air"—but *training builds bright futures!* If you want to be realistic — and your boss is! — consider whether you are sufficiently trained to hold that better job you'd like to have. And be honest!

100,000 ambitious men — men like yourself — are now getting the training they need to succeed through the International Correspondence Schools! They find that I. C. S. textbooks (prepared at a cost of over \$5,000,000) and methods (perfected through 47 years' experience) give them knowledge and training they could not otherwise acquire!

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★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X: ★

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| <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> Machinist <input type="checkbox"/> Toolmaker | <input type="checkbox"/> Marine Engineer | <input type="checkbox"/> Navigation |
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Name.....Age.....Address.....

City.....State.....Present Position.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada
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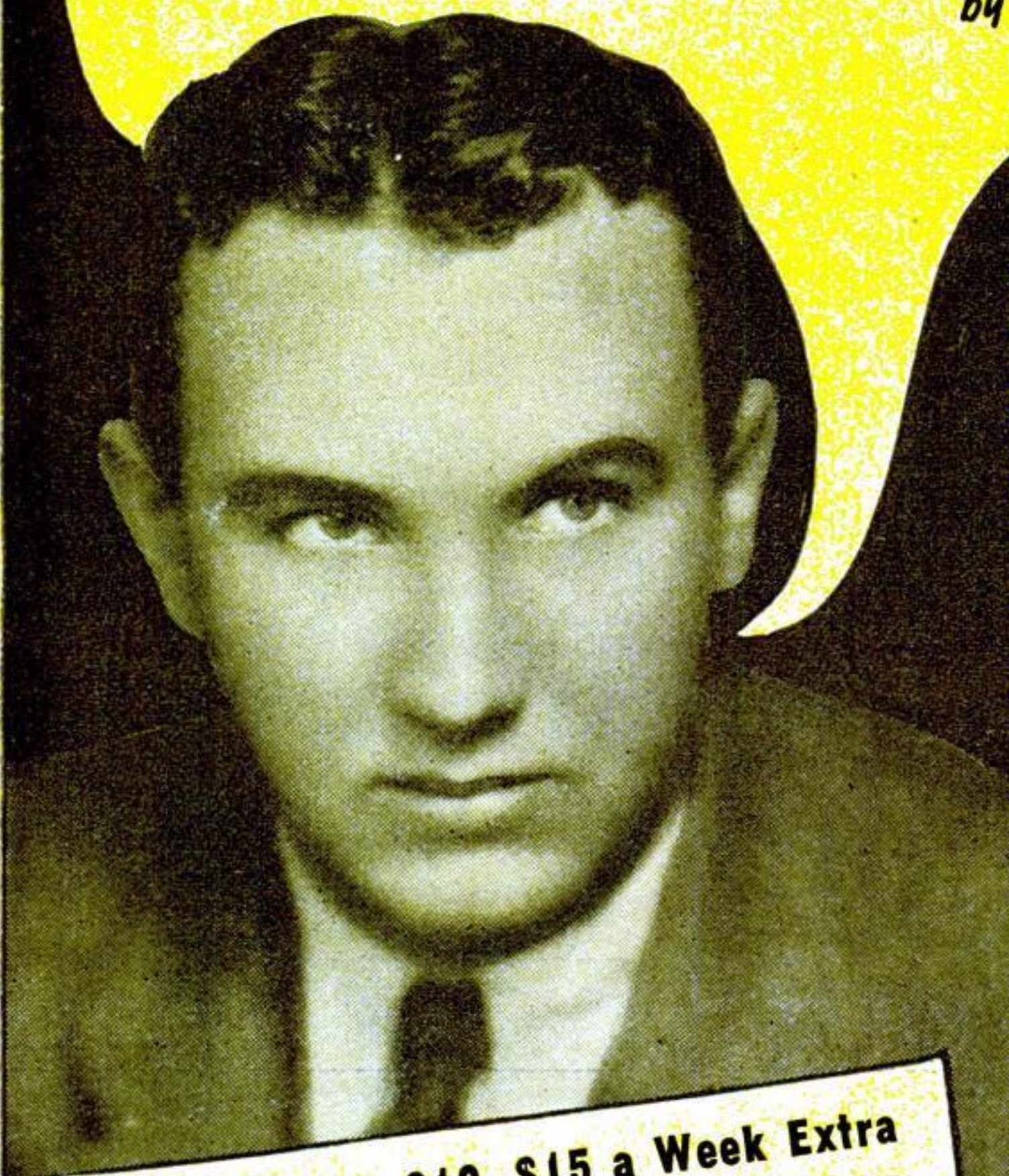
I Jumped from \$18 a week to \$50

--A FREE BOOK STARTED ME TOWARD THIS

Good Pay in Radio

--- HERE'S HOW IT HAPPENED

by S.J.E. (NAME AND ADDRESS SENT UPON REQUEST)



Many Make \$5, \$10, \$15 a Week Extra in Spare Time While Learning

The day you enroll, in addition to our regular Course, I start sending Extra Money Job Sheets; show you how to do Radio repair jobs. Throughout your training I send plans and directions that made good spare time money—\$200 to \$500—for hundreds, while learning.

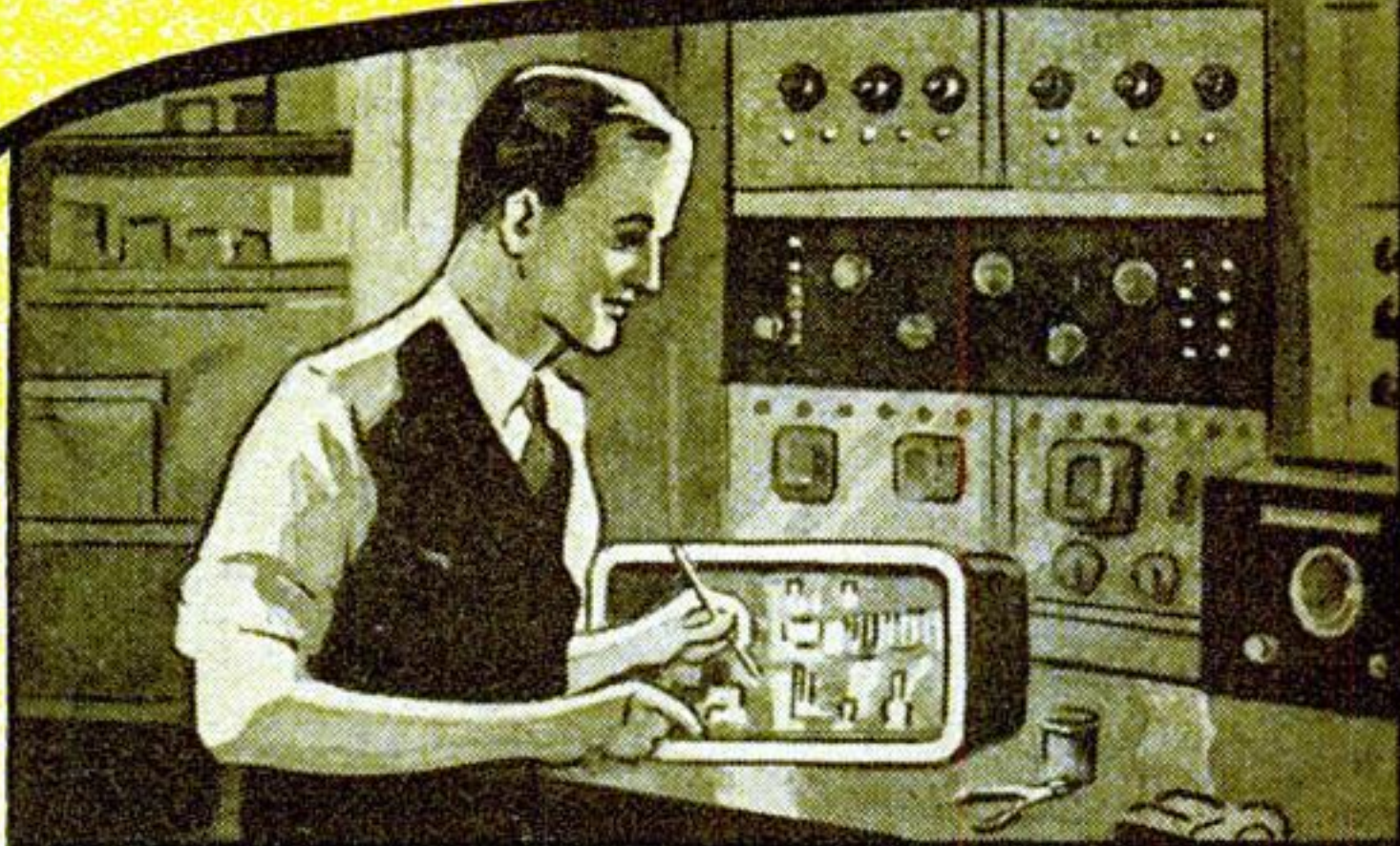
Over \$1,000 Before Graduating

"Before completing half the N. R. I. Course I was servicing sets, and I made \$1,000 to \$1,200 before graduating. I am doing Radio service work for myself now."—ASHLEY G. ALDRIDGE, 1228 Shepherd St., Petersburg, Va.



\$10 to \$25 a Week in Spare Time

"I am making from \$10 to \$25 a week in spare time while still holding my regular job as a machinist. I owe my success to N. R. I."—WM. F. RUPP, 203 West Front St., West Conshohocken, Pa.



"When I finished training I accepted a job as serviceman with a Radio store. In 3 weeks I was made service manager at more than twice what I earned in the shoe factory."

BE A RADIO

Find out How I Train

Radio offers you many opportunities for well-paying spare time and full time jobs. And you don't have to give up your job, leave home or spend a lot of money to train to get those jobs—to become a Radio Expert.

Many Make \$30, \$50, \$75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay up to \$5,000 a year. Fixing Radio sets in spare time pays many \$200 to \$500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as \$30, \$50, \$75 a week. Many Radio Experts open full or part time Radio sales and repair businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, and pay up to \$6,000 a year. Automobile, police, aviation, commercial Radio, loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio. Read how they got their jobs. Mail coupon.

How You Get Practical Experience

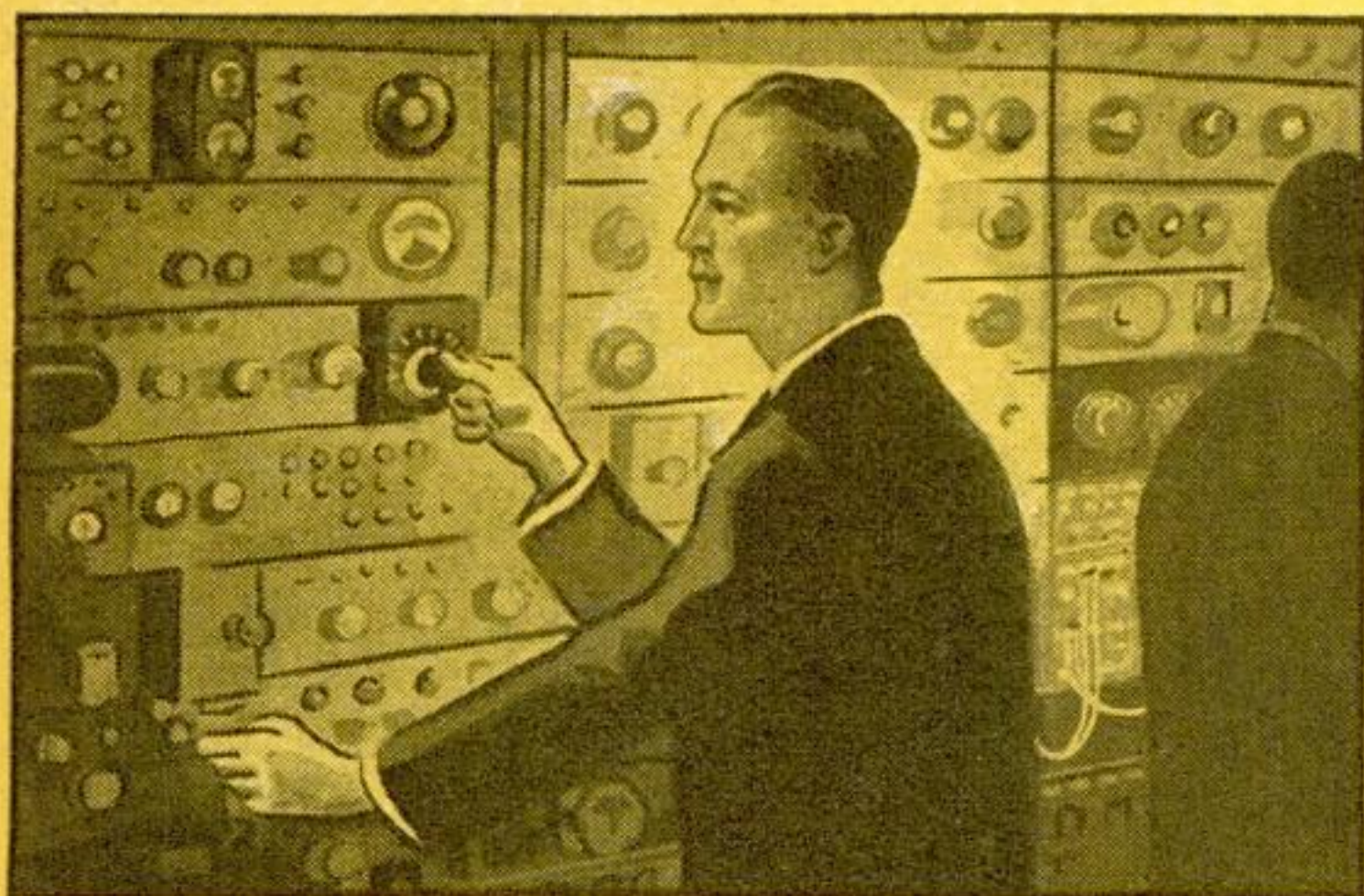
I send you special Radio equipment; show you how to conduct experiments, build circuits illustrating important principles used in modern Radio receivers, broadcast stations and loud-speaker installations. This 50-50 method of training—with printed instructions and working with



"I had an \$18 a week job in a shoe factory. I'd probably be at it today if I hadn't read about the opportunities in Radio and started training at home for them."



"The training National Radio Institute gave me was so practical I was soon ready to make \$5, \$10, \$15 a week in spare time servicing Radio sets."



"N. R. I. Training took me out of a low-pay shoe factory job and put me into Radio at good pay. Radio is growing fast. The field is wide open to properly trained men."



"Eight months later N. R. I. Employment Department sent me to Station KWCR as a Radio operator. Now I am Radio Engineer at Station WSUI. I am also connected with Television Station W9XK."

EXPERT You at Home

Radio parts and circuits—makes learning at home interesting, fascinating, practical. I ALSO GIVE YOU A MODERN, PROFESSIONAL, ALL-WAVE, ALL-PURPOSE RADIO SET SERVICING INSTRUMENT to help you make good money fixing Radios while learning and equip you with a professional instrument for full time jobs after graduation.

Money Back Agreement Protects You

I am so sure I can train you to your satisfaction that I agree in writing to refund every penny you pay me if you are not satisfied with my Lessons and Instruction Service when you finish. A copy of this agreement comes with my Free Book.

Find Out What Radio Offers You

Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

J. E. Smith, President, National Radio Institute, Dept. 8KP3, Washington, D. C.



J. E. SMITH, President,
National Radio Institute.
Established 1914

The man who has directed the home study training of more men for the Radio Industry than any other man in America.



MAIL THIS NOW
Get 64 Page Book Free

J. E. SMITH, President, Dept. 8KP3,
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out spare time and full time opportunities in Radio, and explains your practical method of training at home in spare time to become a Radio Expert. (Please write plainly.)

Name.....Age.....

Address

City.....State.....

Our Readers Say

Limelight and Fan Mail Descend on Fanning Island

THANKS for your very generous response to my appeal for assistance in solving the hound-and-rabbit problem.

IMAGINE, WRITER'S CRAMP
ON A DESERT ISLAND!

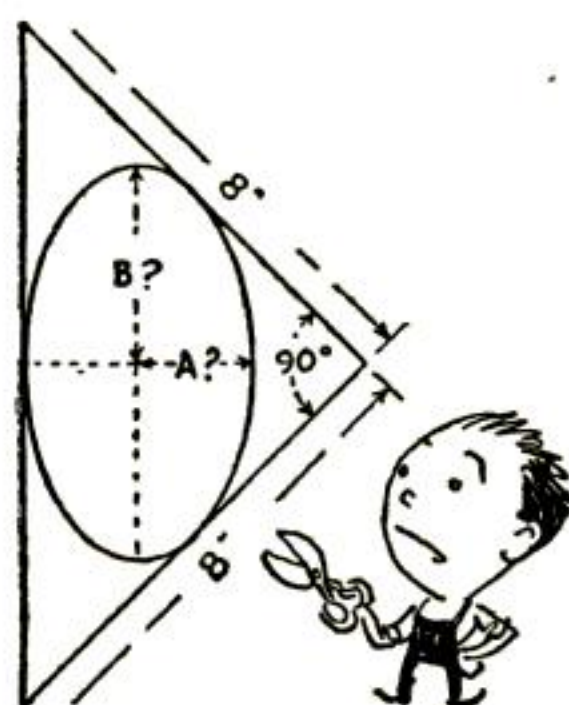


Your publication of my effusion came as an almost embarrassing surprise, but your fortunate abbreviation of my initials to "J.J.O." mercifully dimmed in some measure for me the full glare of your powerful limelight. That it is powerful is proved by the fact that in the last mail I got many letters from good fellows in

various parts of the U.S.A., and there will be most likely many more in our next mail, which is due three days hence. Some of these letters were intensely interesting, particularly the one from S.A.M., of Sykesville, Md., who was responsible for the problem in question, and I am indeed grateful to you for having put me in touch with a fine lot of guys who are more or less math' addicts. Correspondence with them already has done a lot and promises to do much more to relieve the tedium of the isolated existence of myself and my handful of companions here at the cable station on our far-away, mid-ocean island.—J.J.O., Fanning Island, via Honolulu.

Fanning Islanders Please Note: It's S. A. M. Again

This problem has proved of interest to some of my friends. When, and if, you can find space for it, it may also interest the members of the figuring fraternity among your readers who crave a little mental exercise. A copper-smith had a job which left him with 200 right triangles of sheet copper with eight-inch legs. He proposed to use these for the ends of 100 floats of circular cross section, and, being Scotch, he wanted to avoid waste. I told him he could save by making the cross section of the floats elliptical, and he welcomed the hint. What are the dimensions of the ellipse which entail the least waste of sheet copper? It is obvious, of course, that the smith will have to trim off the corners of the triangles anyway, but remember, he wants to use as much of the metal as possible for the ends of the floats.—S.A.M., Sykesville, Md.



Sesquipedalian Polysyllabifications Get in His Hair

LEXICOGRAPHERS indubitably derive incalculable entertainment from the compendium of excessively extended polysyllabifications submitted for typographical representation and occasionally being included by you among the epistolary documentations collected and columnified for their edification. Instead of incrementing this compilation by multiplication of the orthographical monstrosities and extending the sesquipedalian compendium into a *reductio ad absurdum* hodgepodge of the chemists' latinizations, why don't you get wise and call the whole thing off?—A.B., Bound Brook, N.J.

YOU SAID A MOUTHFUL!
MISTER!

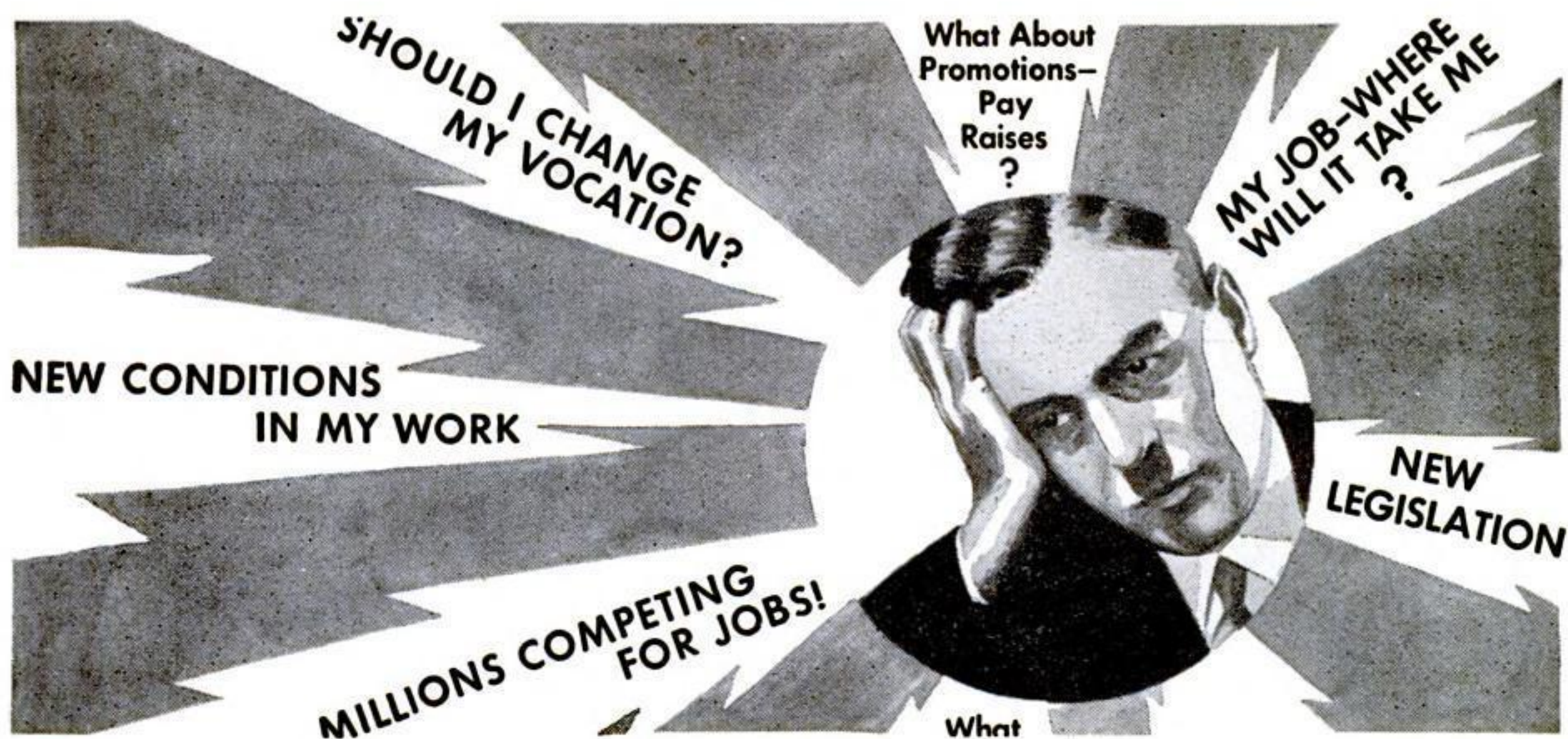


So That's What They Mean When They Say "In-car-cerated"

HOBOS arrested for vagrancy in Calhoun County, Mich., must have felt perfectly at home when they found themselves "sent away" in the steel railway car used as a temporary jail, described in your September issue. Considering the appearance of the pinch-hitting calaboose, however, I think that rations of hamburgers (with onion) would have been more appropriate than the traditional diet of bread and water.—J.L., Indianapolis, Ind.

Water Sports of Water "Sports" Are Safer Now, Anyhow

THANKS a thousand times for those "Safety Hints for Water Sports" in your September issue. The water "sports"—we have three, aged nine to fifteen—at our lakeside cottage are a real source of worry to their parents. When the better half of those parents discovered your article, she called a meeting of our small clan and said, "Nobody's going swimming or boating again until every word of this article has been read and every picture studied carefully!" There were the usual groans, of course, but they stopped as the kids and their father, one by one, obeyed. The "Don'ts" made so much sense, and the illustrations were so vivid, that we were all intrigued with them. I bought another copy of the magazine and pasted the three pages on a cardboard backing, covering the whole thing with weather-proof isinglass. Your (Continued on page 14)



WHERE DO YOU GO FROM HERE?

YOU'RE like a million other men—you're facing a *big* question. The depression turned business topsy-turvy and now the rebuilding period stares you in the face.

Are the things that are happening today going to help or hinder you—what will they mean in your pay check? Where will they put you five, ten, twenty years from now? How can you take full advantage of this period of opportunity?

We believe you will find the answer here—a suggestion the soundness of which can be proven to you as it has been to thousands of other men.

The whole trend today—legislation, spirit, action—is to put men back to work, raise earning and spending power, *give every man a fair chance to work out his own salvation.*

The road to success remains unchanged but, bear this in mind, *what it takes to win is radically different!*

No employer today would dare risk an important post in the hands of a man who had not learned the lesson of '29. Why should he, when right at this moment he can pick and choose and get almost any man he wants at his own price?

Business organizations are rebuilding—reorganizing for the new conditions. Before it is over every man and every method will be judged in the cold light of reason and experience—then dropped, re-made or retained. This spells real opportunity for the man who can meet the test—but heaven help the man who still tries to meet today's problems from yesterday's standpoint! Out of the multitude still

jobless there are sure to be many frantically eager to prove him wrong and take his place.

Some Men Have Found the Answer

Seeing these danger signs, many aggressive men and women are quietly training at home—are wisely building themselves for more efficient service to their employers.

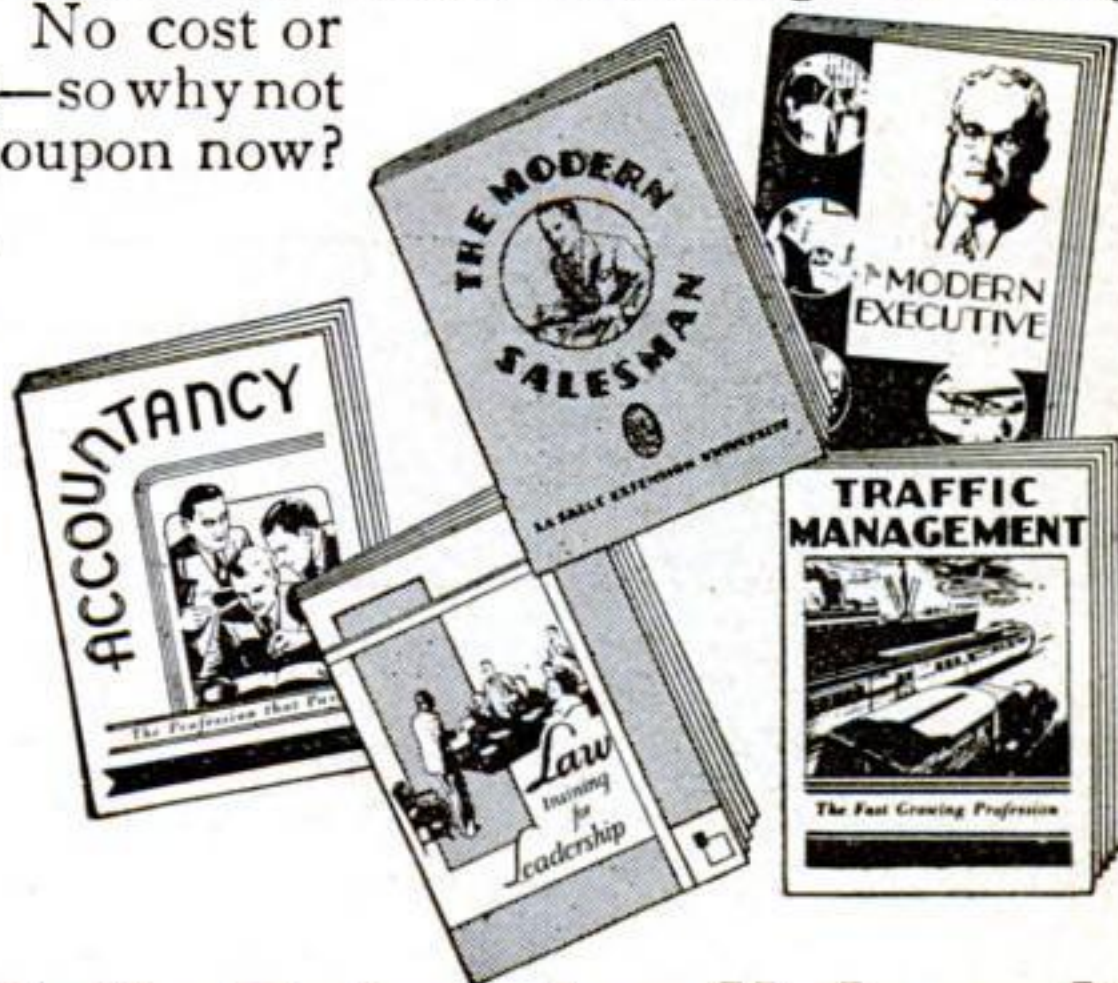
You naturally ask, "Has your training helped men withstand conditions of the last few years?"

Our answer is to point to a file of letters from many of our students reporting *pay raises and promotions while business was at its lowest ebb*—together with a myriad of others telling of greater success during these recent months of recovery.

Unusual evidence is ready for your investigation. We have assembled much of it in a booklet that is yours for the asking, along with a new and vitally interesting pamphlet on your business field.

This is a serious study of the possibilities and opportunities in that field. It is certain to contain an answer to vital questions bothering you today about your own work and earning power.

Send for these booklets—coupon brings them free. Be sure to check the LaSalle training that interests you most. We will tell you also how you can meet and take fullest advantage of today's situation. No cost or obligation—so why not mail the coupon now?



LASALLE EXTENSION UNIVERSITY, Dept. 1083-R, Chicago

Please send me—without cost or obligation—full information about how I can, through your training, equip myself for the new problems and opportunities in the business field I have checked.

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| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Business Management |
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| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Business English |
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| <input type="checkbox"/> Modern Foremanship | |

Name Age.....

Position.....

Address

LaSalle Extension University
A CORRESPONDENCE INSTITUTION

Our Readers Say

article now has a permanent mounting on the dock where we swim and tie up our boats, for everyone to see.—H.G.W., Watkins Glen, N. Y.

Finding Needles in Haystacks Is Easy by Comparison

INVENTIONS, inventions, and still more inventions. Mechanical do-funnies will do practically everything for you now, from scratching your back to mixing your drinks; but have you ever tried to get all of the pins out of a brand-new shirt? I can't. I hunt and I hunt, but when I slip the shirt on my back a sharp jab in the arm informs me that there's still one lurking in some seam or fold. Why can't the manufacturers either discover some other way of tucking shirts into neat bundles or else perfect some sort of giant magnet that'll gather the pins when it's brushed over a new bib?—P.F., New Rochelle, N. Y.



This Fellow Turns the Heat on the Dry-Ice, Car-Cooling Idea

IT IS my understanding that the use of dry ice, frozen carbon dioxide gas, in tightly closed cars is apt to be dangerous due to the likelihood of suffocation being caused by an excess of the gas accumulating in the car. If dry ice is used at all, it seems to me that this danger should be considered, and sufficient ventilation provided in the automobile, as some of the modern car bodies are pretty well sealed up when closed. Am I right?—B.J.D., Anaheim, Calif.

Feels He Has Solid Ground for His Argument

IN A recent issue appeared an article entitled "How Rain May Cause Great Disasters," by Gaylord Johnson, which gave one theory of earthquakes. I don't claim to be a scientist, but the theory seems a little off. He says that the earth has a semiliquid center. This is impossible, as a simple test will show. Take a hard-boiled egg and a raw one, and spin each. The raw egg stops first, because its liquid or semiliquid center causes the raw egg to become unbalanced. The hard-boiled egg spins until fric-



tion stops it. The same holds true with the earth. If it had a semiliquid center, it would have ceased to rotate long ago. Near the center of the earth there may be molten lava, but I doubt it. There is intense heat, but the pressure is so great that the hot minerals are solidified. Then what is the source of surface lava? Well, if any of several possible circumstances suddenly created an outlet to allow the hot substance to escape from the high pressure, it would immediately turn to liquid.—H.W.V.V., Canby, Ore.

One Reader Thinks Science Should Lay Off the Bed

MY IDEA of making night hideous would be to try to sleep in the gadget-infested bed you pictured in a recent issue. Isn't it enough to spend our waking hours surrounded by push buttons, dials, and switches, without having to sleep with an instrument panel that would make the cockpit of the *China Clipper* look like the one-horse shay? When I go to bed I don't want to be bothered with any telephones, radios, or window-opening robots. The only mechanical accessory that a bed needs is a big sign: "Do Not Disturb."—E.T.M., Baton Rouge, La.

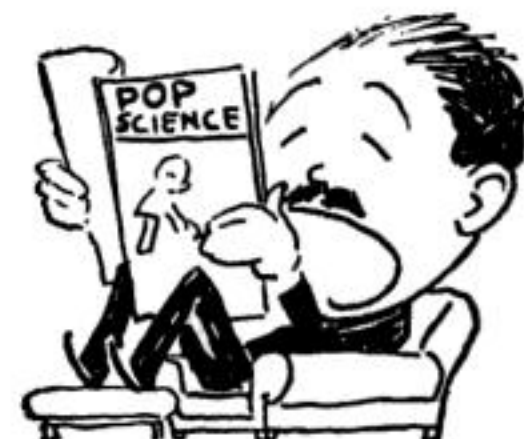
HOW ABOUT A NIGHT CAP?



An Ardent Radio Fan Can't Picture Photography

IN THE letter from A.M.E., the camera fan, I quite disagree with one particular statement, "radio bugs with their useless activities." I'll bet ten to one that A.M.E. has listened many an hour to some of the excellent things that are now being broadcast by radio. Maybe he's been flying with a pilot who suddenly finds himself cut off from the ground, except for his radio. Maybe, too, he has heard of rescues at sea, brought about by distress signals sent by radio. Or he may have seen in a recent P.S.M. article that airplanes can now make safe blind landings—by means of radio alone. The many benefits of modern radio would fill a big book. And it was and is the radio bugs—"with their useless activities"—that are making these things facts. Although your radio pages are for anyone who wishes to read them, I believe they have a large following among [\(Continued on page 16\)](#)

HO-HUM, TWEEDE DUM AND TWEEDE DEE AGAIN!



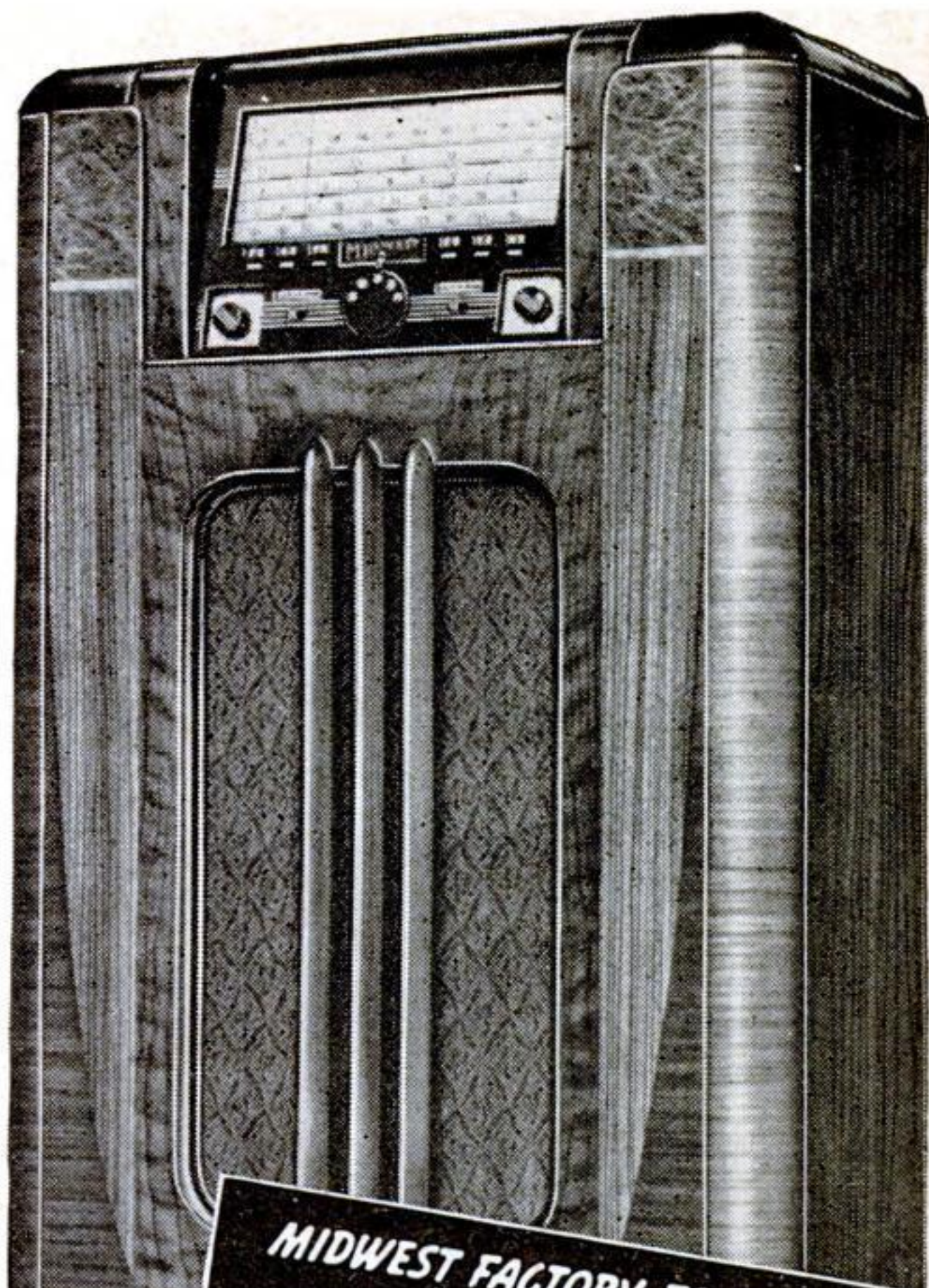
FACTORY-TO-YOU SAVES YOU ^{UP} _{TO} 50%

...Also AS MUCH AS
\$30⁰⁰ _{AND UP} **FOR YOUR OLD RADIO**
AS A SPECIAL TRADE-IN ALLOWANCE!

17-TUBE WORLD-WIDE MIDWEST

ONCE again Midwest scoops the radio world with its new and sensational 1939 radios that just sparkle with new features. Merchandising men, everywhere, are amazed not only at their brilliant world-wide performance, but at their sensationally low factory-to-you prices, which make your radio dollar go twice as far. You buy at wholesale prices, just like a dealer.

While the \$39.95 Midwest "Special" represents one of the most amazing radio values offered today—the Super DeLuxe 5-band "17" and DeLuxe 5-band "12"-tube Midwest, radios are even greater bargains. The new-design, 5-band, 17-active-tube *Midwest, shown here, is an outstanding example of Midwest's greater values. It gives you high priced performance for the cost of an ordinary 10 or 12-tube set. It will delight you with its tremendous 12,000-mile range on 5 bands, glorious new tone and brilliant overseas reception. Stations on the other side of the world come in like "locals." Only Midwest gives you a combination of features like Dial-A-Band Wave Changer, Acousti-Filter, Electric Touch-Button Split-Second Tuning and Fidel-A-Trol! (Only \$76.75 for the Super DeLuxe 17-tube 5-band model illustrated.)



MIDWEST FACTORY-TO-YOU PRICE... \$69.⁹⁵
TRADE-IN ALLOWANCE... \$30.⁰⁰
YOU PAY ONLY
\$39.⁹⁵ ABSOLUTELY COMPLETE
SPECIAL 17-TUBE CONSOLE

**30
DAYS FREE
TRIAL**



**Costs No More To Operate
Than 7-Tube Radio**

HATTIESBURG, MISS.—Midwest has the clearest and sweetest tone of any set I have ever owned. My Midwest surely has been praised above much higher priced radios. I was afraid it would be expensive to operate but it does not cost any more to operate than my seven-tube radio did. (A. N. Green)

Send for the new FREE 1939 catalog and feast your eyes on its history-making values. It pictures many new 1939 models—to suit every purse. The famous Midwest 30-day Trial Plan gives you 30 days to make up your mind. You be the sole judge! If you decide to keep it, you secure as much as \$30.00 credit on your old set. Even higher trade-in allowances on some Midwest models. Don't buy any radio until you see for yourself how and why Midwest gives you so much more for your money!

AMAZING NEW EASY-PAY PLAN

**SEND FOR FREE 1939
FACTORY CATALOG**

You save up to 50%, and make your radio dollar go twice as far when you order direct from the Midwest Factory. Remember, you get 30 days FREE trial. Midwest guarantees your absolute satisfaction. Write today for FREE 1939 catalog.



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OCTOBER, 1938

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Our Readers Say

the amateurs who learn from them what new apparatus is available and how they can make use of it in furthering the development of radio for the benefit of the public, including A.M.E. Anyone, with a little sober thought, can see that. A.M.E. says "Ask any camera fan if photography isn't the king of hobbies." Well, ask any radio fan for me if Marconi's activities were useless.—O.M., Andover, N. Y.

We'll Stick to the Snake-Bite Cure That Comes in a (Bonded) Bottle

TURNING through some of my back issues of P.S.M. recently, I found a letter from S.S.C., of Paris, France, in the April 1935 "Our Readers Say." In it, the writer referred to the Nag jewel, which he said was reputed to be found in the Nag (snake) and has the power of sucking even the deadliest of snake poisons from a wound. In India there may be hardly a man who does not know that there exists a

Nag jewel, but none can be brought to testify that he has ever seen one. I, being a medical man, had little faith in such legendary idle gossip—until I was bequeathed this precious and priceless jewel by a Rishi (holy sage), in the jungles of the Himalaya Mountains. It is a most rare thing! It has a mystical yet quite evident charm over snakes, and

they quite readily yield to and obey its powers. It has such an affinity for snake poison that it actually becomes enlivened. It is a shining little thing, brownish in color, circular like a pill with flat sides, and about a half inch in diameter. The efficacy of this precious little gem has been put to the test by me many times, and leaves no room for doubt. I am of the impression that a country so advanced as yours might have one of these jewels, and has produced an explanation of the mystery. In my capacity as physician and surgeon, I would welcome a scientific explanation.—B.L.P., Lahore, India.

Says Our Navy Just Escaped Falling Behind Dangerously

Not long ago, Secretary of State Hull announced our continued determination to maintain the "5-5-3 ratio" of naval strength for the United States, Great Britain, and Japan. How far we have let ourselves lag behind this ratio is vividly shown by your charts and information on the current naval race. It might be of interest to add that the actual standing in under-age tonnage of the "Big Three" naval powers on January first of this year was: Great Britain, 5.20; United States, 4.45; Japan,

3.35. Even with the completion of our tremendous building program, we shall only partly catch up, for the figures will then be: Great Britain, 5.11; United States, 4.60; Japan, 3.29. It isn't hard to see how dangerously we would have fallen behind our naval-race competitors without the building plans now authorized by Congress. And by the way, because of our part in the expansion program, some people will doubtless be saying that the United States is bringing about a new arms "race." Your article is the best reply to this that could possibly be made, for since we aren't trying to win it, how can it be called a race? —B.N., Brooklyn, N.Y.

He's Got a Honey of a Problem and He's Stuck with It

WITH a quantity of old honey on hand, I'm stuck. I'd like to feed it to my young bees, but I'm afraid to for fear it has started to sour, and sour honey is fatal to bees. Can any of your readers suggest a test for sourness and a remedy for it? Incidentally, I recently completed the building of your "New Sectional Boat" according to your description (P.S.M., April and May '38). The clear and explicit details helped me to make a first-class job.—G.D., Estero, Fla.

WHAT TO DO ABOUT THAT HONEY?



You Might Answer This Argument with a Tire Gauge and Auto Jack

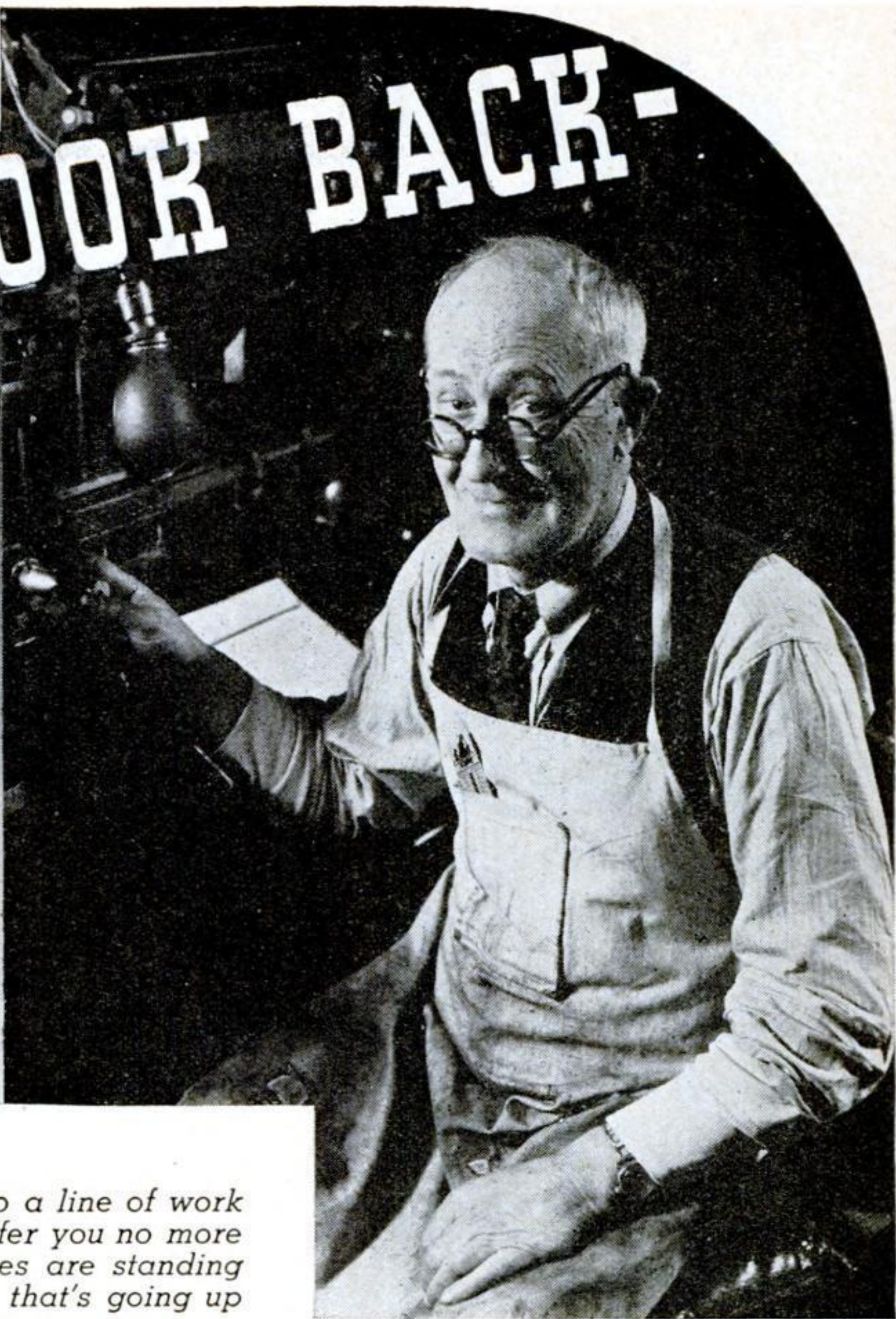
NEITHER of us owns a car, so this argument is purely academic. Perhaps one of your motoring readers can settle it for us. A insists that you should keep your spare tire inflated at a lower pressure than the others, because the weight of the car increases the air pressure when the tire is put on a wheel. B says that A may be right in theory, but that actually the difference in pressure would be so slight that it wouldn't be noticeable. The proof of that, he declares, is the small amount that the weight of the car flattens out the bottom of the tire, compared to the total volume of the air chamber. And the pressure of a given quantity of air, he points out, is inversely proportional to its volume. While it is not a matter of any great importance, we would like to know which one is right, A or B. —G.H., Allentown, Pa.

WHY IS IT ALWAYS FLAT ON THE BOTTOM?



WHEN I LOOK BACK-

I see how
YOU
can get ahead



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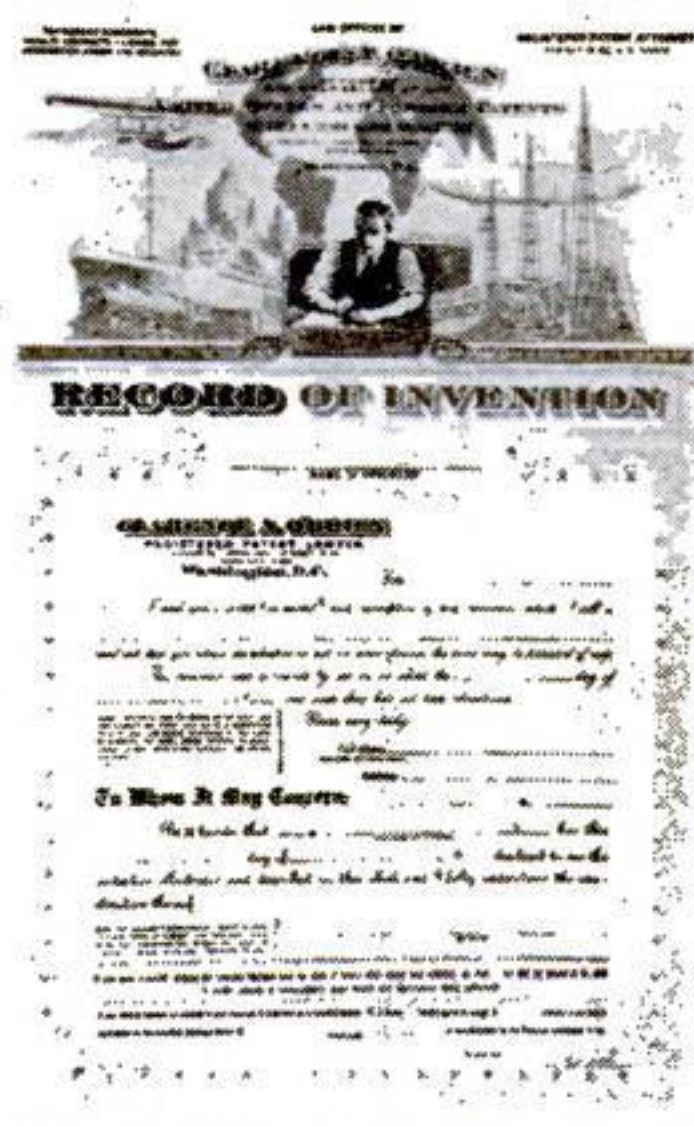
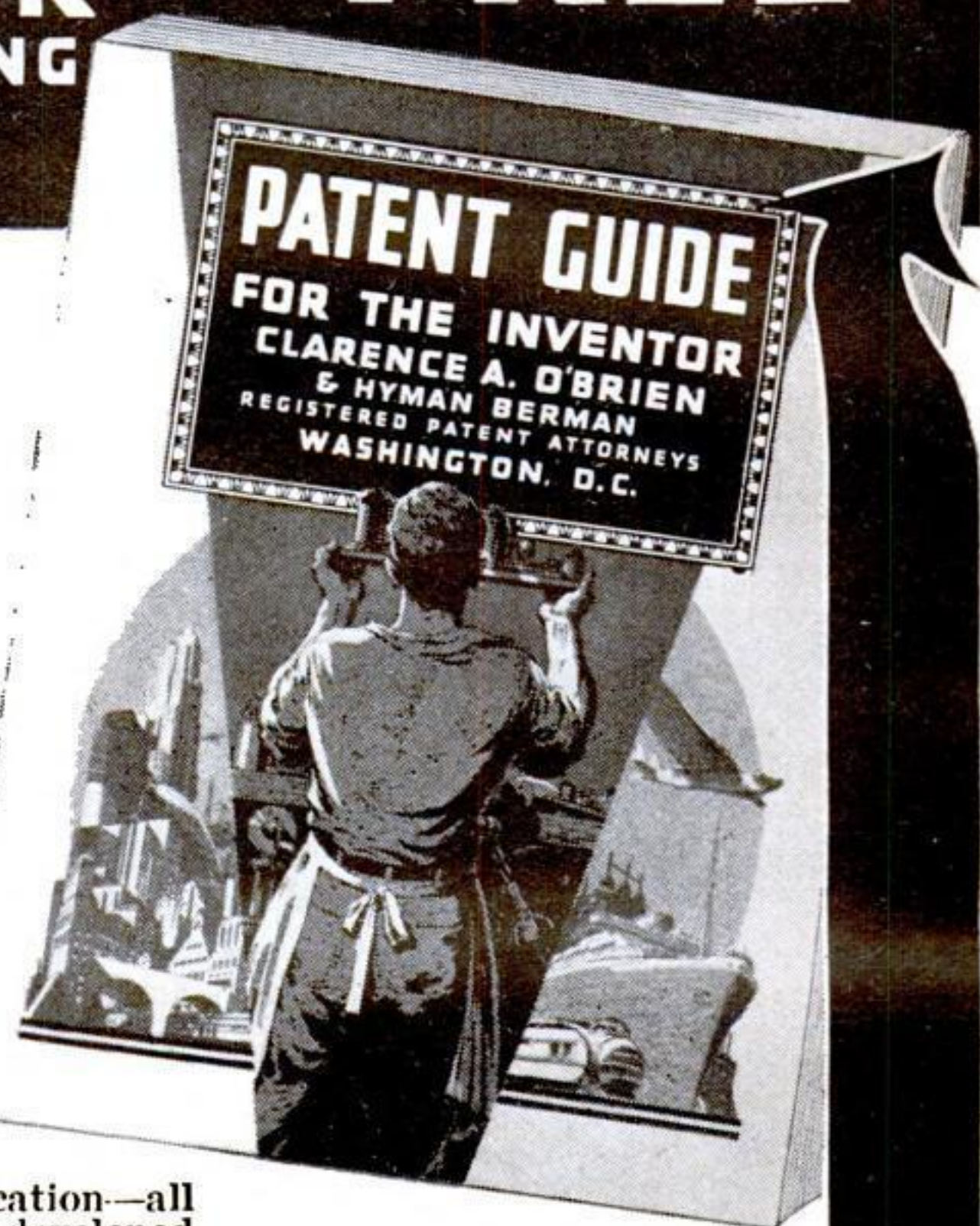
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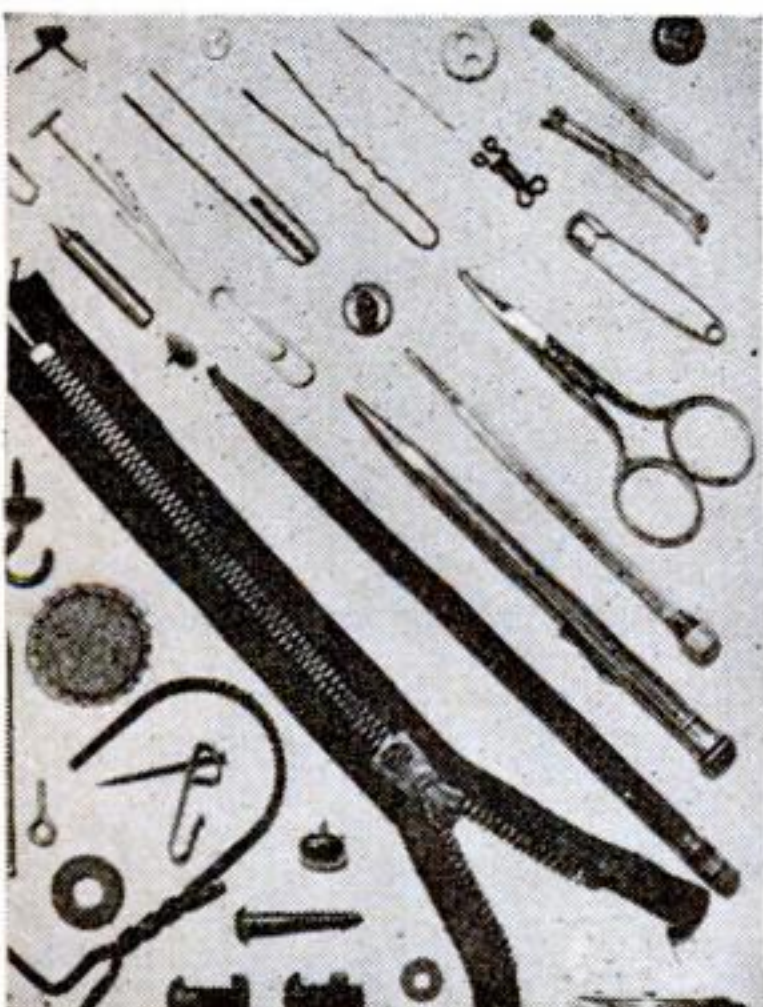
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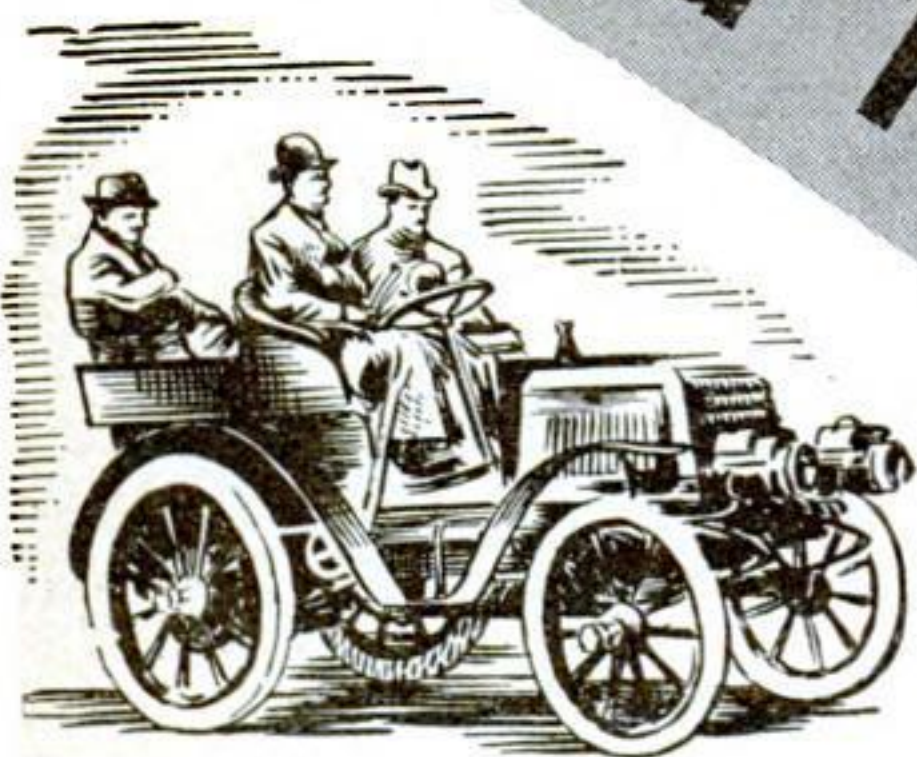
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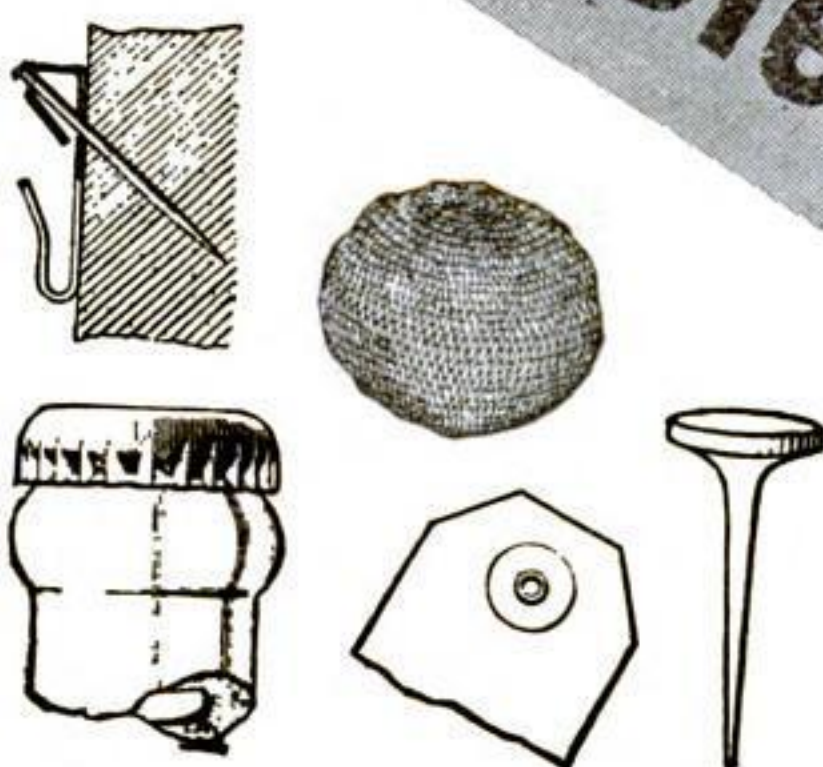
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Simple Inventions May Have Excellent Commercial Possibilities

Frequently inventors confuse the size or the complication of a device with the question of commercial value and patentability. These two factors, of course, have no relation to each other. Most of our present-day complicated machines represent a process of evolution, a series of inventions. On the other hand, every so often some inventor comes along with a very simple "gadget" which possesses the elements of broad utility and is patentable. Some of the most profitable inventions have been of this latter class. Shown above are a few such examples. Whether a device is simple or complex, if it represents a forward step to save manufacturing costs, to save labor, or to add enjoyment to human life, it may prove patentable and profitable. This subject is more fully discussed in the booklet entitled "Patent Protection" shown on the opposite page.



What Will Be Next?

Ever since George Washington signed the first patent, America has led the world in inventions. It may be said that not a year has gone by without some important inventions being patented and commercialized. David Sarnoff, President of the Radio Corporation of America, sees a big future ahead for science and invention. Just as sure as the sunrise, 1938 will see new inventions come out—new wealth made from patents. Your idea may be one of them. You never can tell. For this reason you should send for our books today and get the facts about patents and inventions.

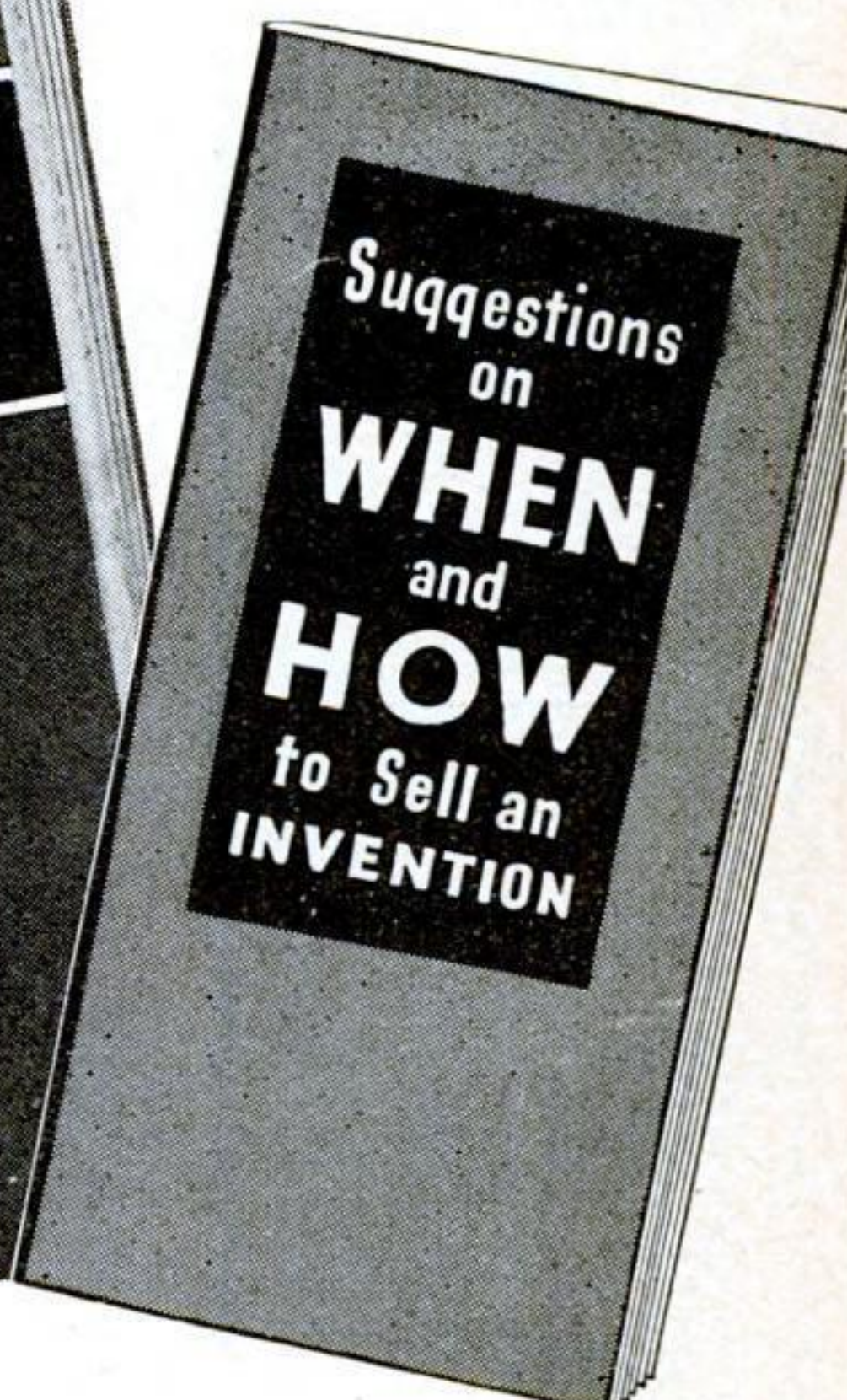
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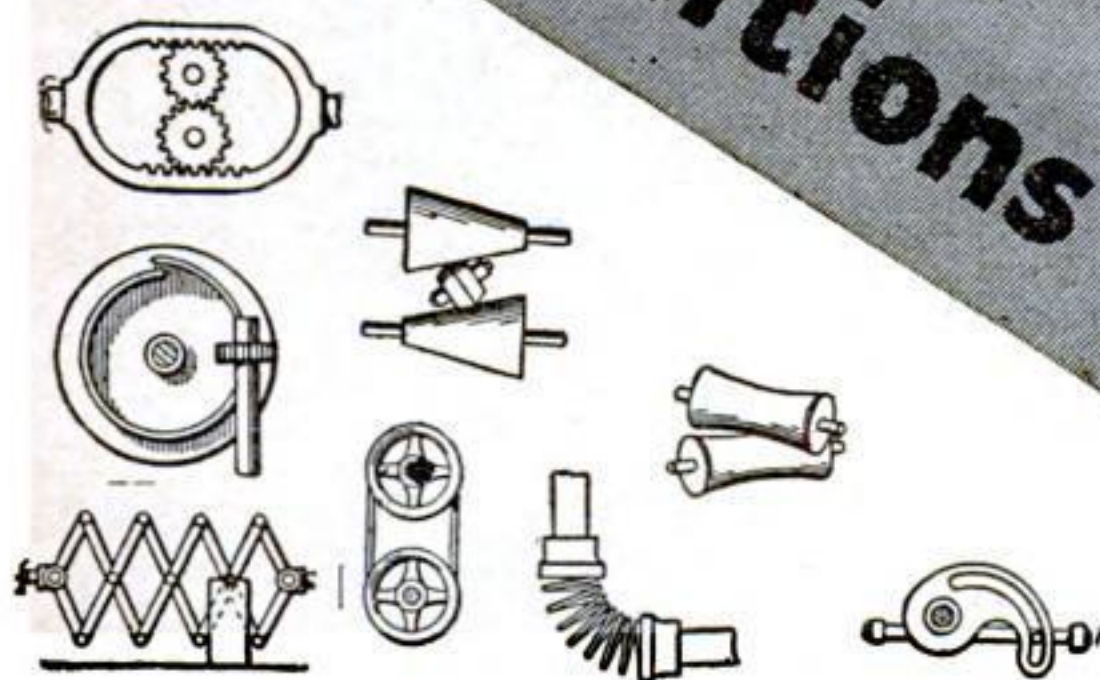


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Dart Gasses Rioters

DESIGNED for police use in quelling riots, a dartlike projectile, the invention of Latham V. S. Blacker, of Coates, England, contains a stupefying gas that is released when the projectile strikes any object or the ground. Fitted with a rubber head, the gas shell is larger than the human eye socket so that it cannot cause dangerous eye injuries. The gas, although strong enough to cause unconsciousness, is said to do no permanent harm.

Shower-Curtain Anchor

REALIZING that one inconvenience of bathtub showers has always been the tendency of the shower curtain to blow inward, owing to



the movement of air currents, and cling to the bather, John W. Shera, Oak Park, Ill., inventor, thought up the simple solution to the problem shown at the left. A series of wires, attached to the sliding hooks that hold the shower curtain fast to its overhead supporting rod, run down through fabric loops sewn to the outside of the curtain, and terminate in weights that rest against the exterior of the tub. The weighted wires thus make it impossible for the curtain to blow inward against the bather as he takes a shower.

Spout for Fruit Jars

COMMON glass fruit jars can easily be converted into handy pitchers by the spout attachment shown below. The invention of Theolian Gamble, of Des Moines, Iowa, the household attachment has a built-in handle, a projecting pouring lip, and a hinged cover that is held in closed position by means of springs. The pitcher top is screwed onto threads of the jar.



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This valuable cup stands about 14 inches high on a black mahogany base.

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* Miss R. P., Southmont, N. C.



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* Mr. E. C. R., Pemberville, Ohio.

* Actual pupils' names on request
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Name.....
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Floating Baby Bathtub

TO MAKE it easier to bathe infants in an adult-size bathtub, Betty E. Prince, of Charleston, W. Va., devised the floating tub illustrated. Made of rubber, the baby tub has perforated walls and bottom, with a rim that is inflated with air through a valve.



Instead of resting on the bottom of the bathtub, where it is difficult to reach, the baby tub floats on top of water run into the large tub and is filled to a convenient depth.

Vacuum Cups Hold Roast



PREVENTING roasts from sliding around on the platter while they are being carved is the purpose of a clever invention of George B. Markle, Jr., of Hazleton, Pa. Rubber vacuum cups, fitted with spikes extending from one

end, are attached by pressure to the carving platter. The meat is then pressed onto the spikes, which hold it firmly in place while it is being cut. The meat holders are easily removed when the platter is to be washed.

Comb Applies Hair Tonic

SCALP TONICS and hair lotions can be applied while combing the hair with a novel fountain comb. Devised by William J. Kot-sopoulos, of Los Angeles, Calif., the comb has a hollow head that holds a quantity of liquid hair dressing. As the comb is passed through the hair, the liquid flows out, making it possible to spread the fluid evenly through the hair. By means of an adjustable screw in the air inlet to the hollow comb head, the rate of flow of the hair tonic can be controlled at the will of the person using it.



1939 1940 1941 1942 1943 1944 1945 1946 1947 1948



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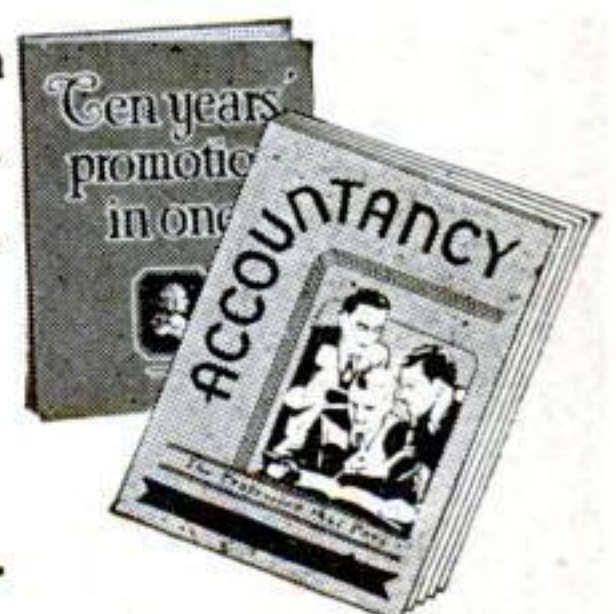
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OCTOBER, 1938

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Long-Eakins Company
1047-S High St.

Springfield, Ohio



Head Guard for Batters

A NEW form of head protector for baseball players has just been invented by Edward Larkin, of Washington, D. C. Intended to be worn by batters in place of the regulation baseball cap, the protector has a hard outer casing lined with inflated rubber cushions that take up the shock and prevent injury in case a ball hits the head of the wearer. Open at the crown, the protector has an eye-shading visor.



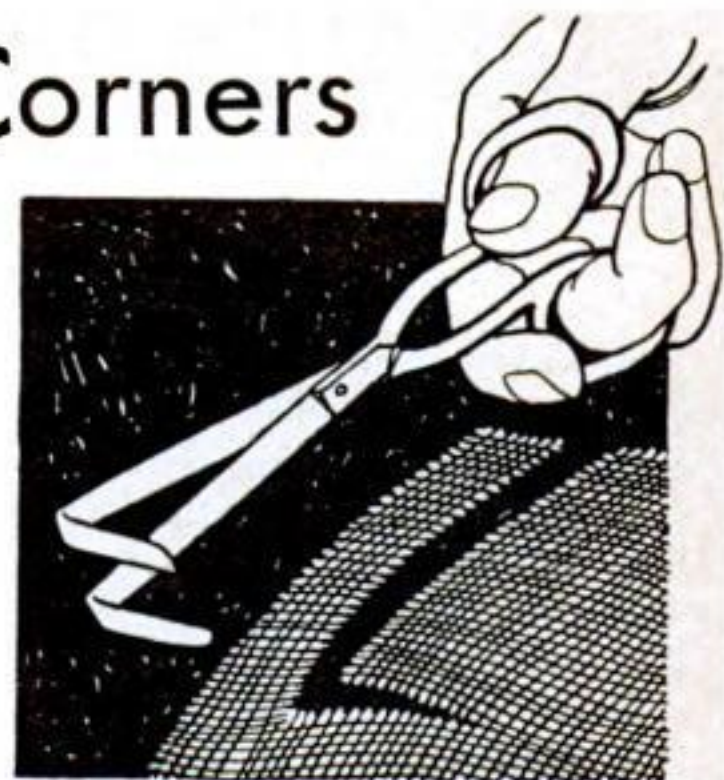
Faucet Soap Dispenser



SOAPY water runs from faucets equipped with a dispenser devised by William Kundel, of Hoboken, N.J., which releases liquid soap into the central outlet of a hot and cold-water fixture.

Shears Cut Corners

SHEARS that enable the user to cut around corners are the invention of Joseph Soss, of Roselle, N. J. The new cutters are made like conventional scissors except that their ends are bent as pictured at the right. In one motion, therefore, the new shears will slice a cut in one direction and start a second cut at right angles to the first.



Flowerpot Is Flexible



POTTED plants are cultivated by squeezing the sides of a new flowerpot, made of a pliable material, to move and loosen the soil around the plant roots. The flowerpot was invented by Morris Langa, Philadelphia, Pa.

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Without risking a penny prove—right in your own home—that a Royal will help you—whatever your business or profession—help you to set down your ideas and reports *legibly, impressively*. Prove! too, that it will help the children with their homework . . . *help every member of your family with their writing!*

READ WHAT ROYAL GIVES YOU! Standard, full-sized keyboard. Easy, effortless action. Touch Control, Finger Comfort Keys, Genuine Dust Protection, Automatic Paper Lock, Touch-set Tabulator and many other office typewriter features. Tested, proved, guaranteed!

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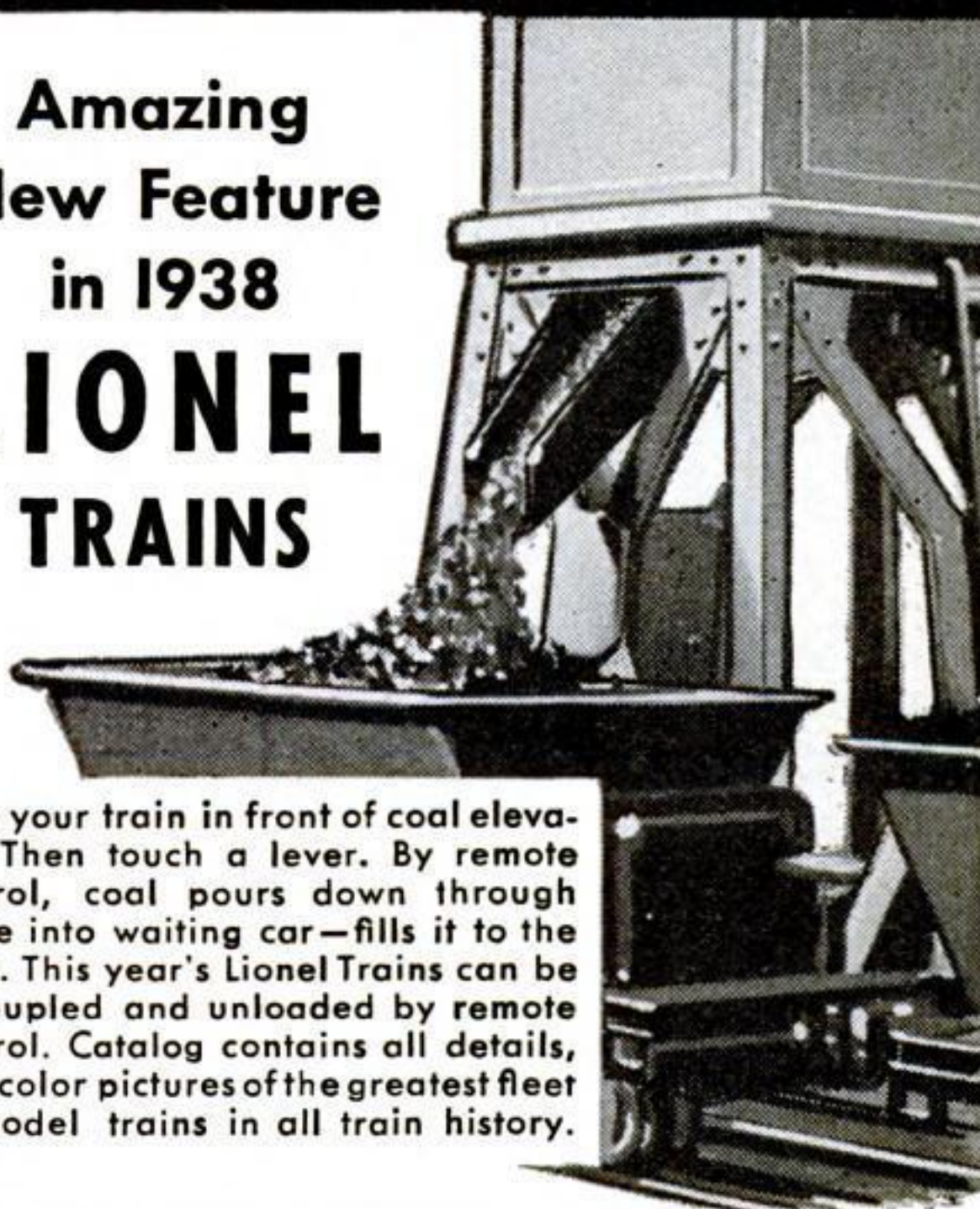
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Needles Get Eyelids

TO MAKE the task of threading a sewing needle easier, Alonzo H. Little, of Los Angeles, Calif., devised the novel needle eye pictured at the right. A hinged metal unit pivoting on its lower end can be swung open to allow thread to be passed easily into the needle's eye and then closed to hold it in place. One side of the hinged member is edged for cutting the thread when desired. The hinged opening is said not to interfere with sewing operations, being designed so that when closed, there are no projecting edges to catch in the fabric.



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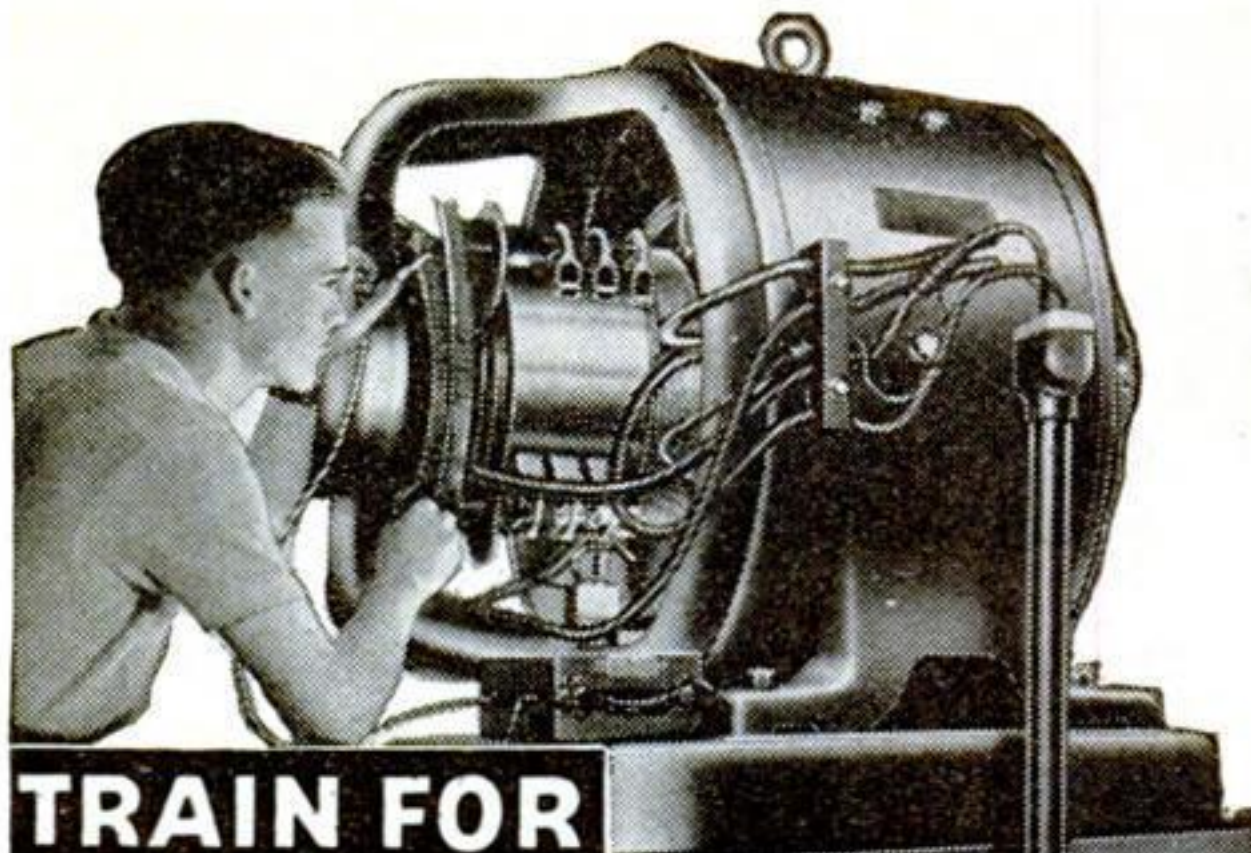
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CHRISTMAS cards. Absolutely finest assortment. Big profits. Write for samples. Robinson Cards, 431 Orange, Clinton, Mass.

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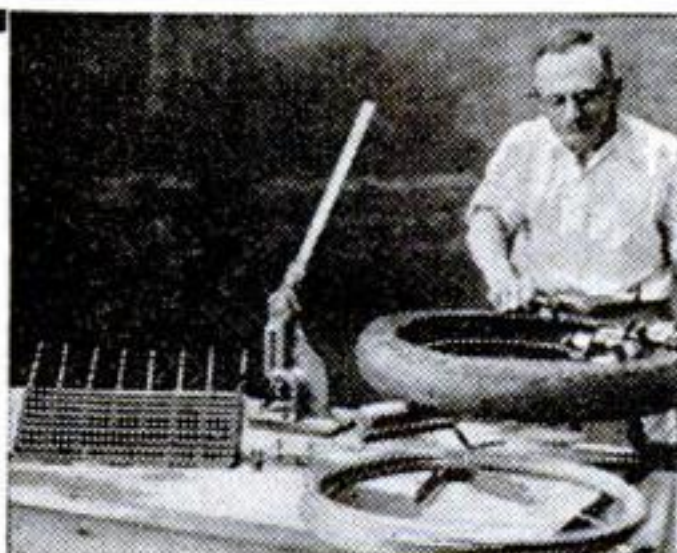
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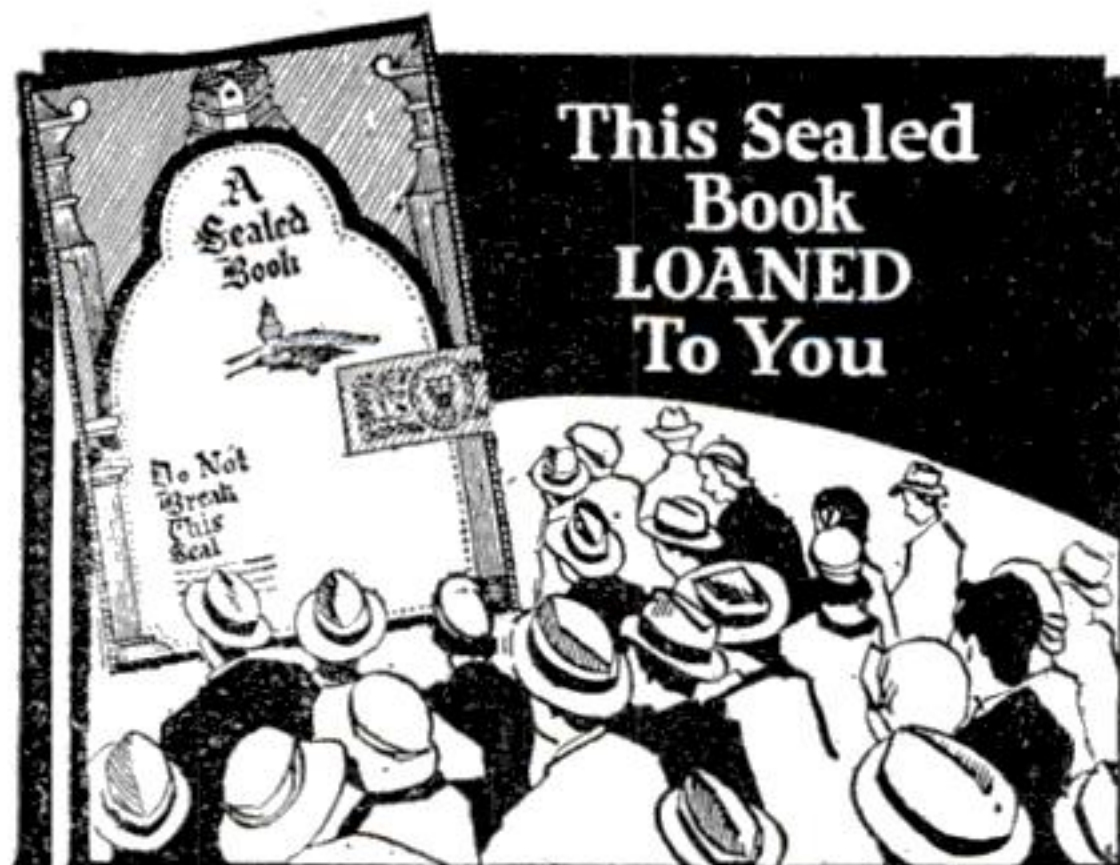
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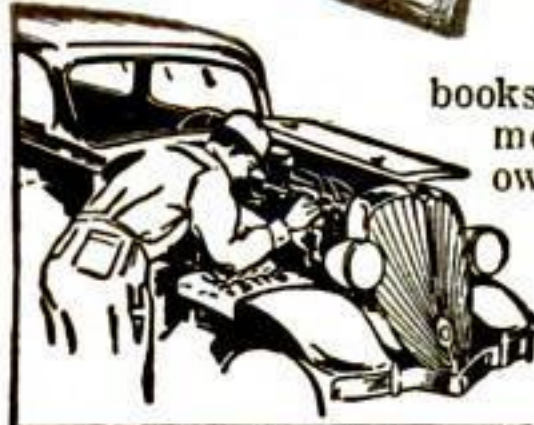
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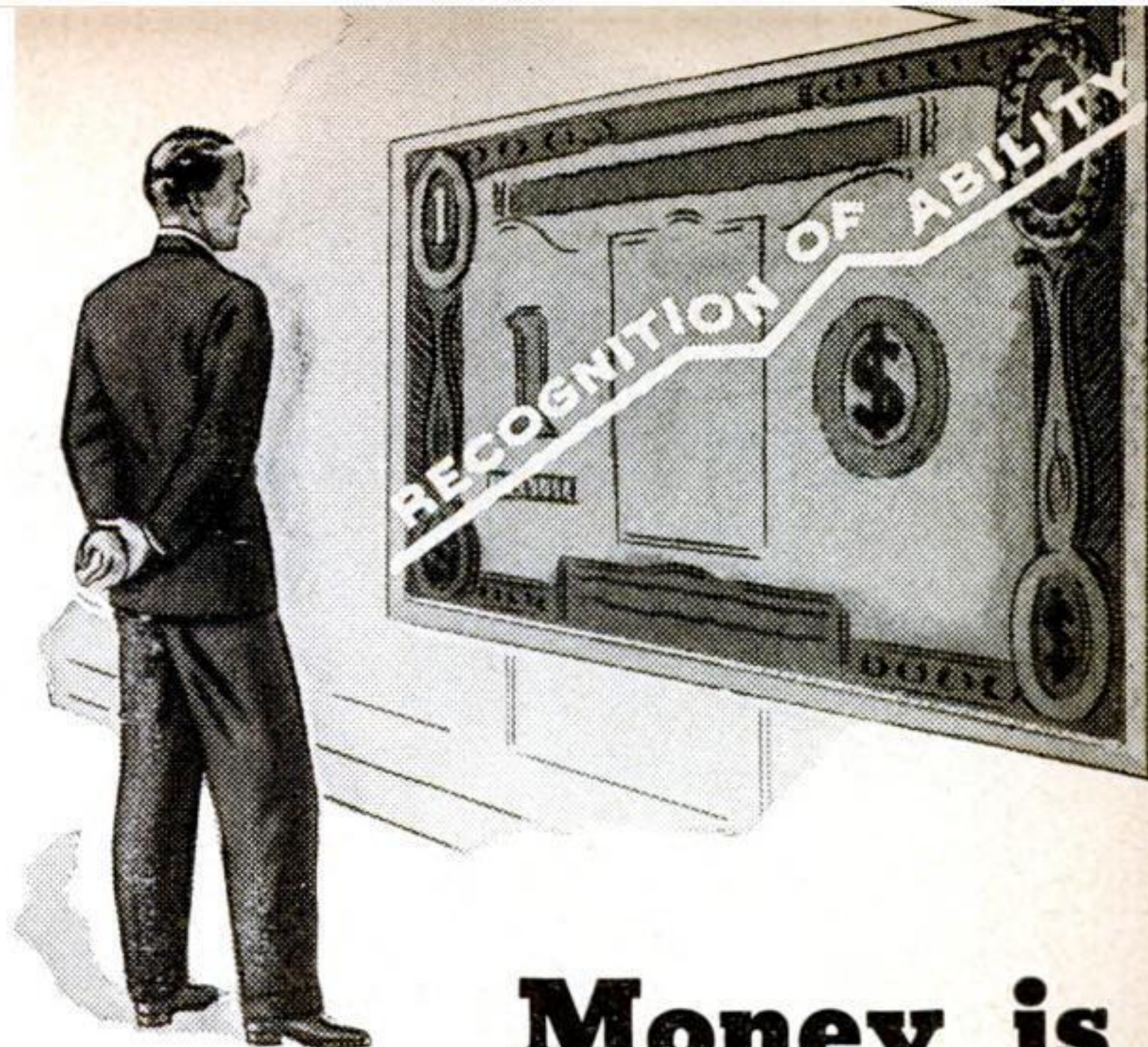


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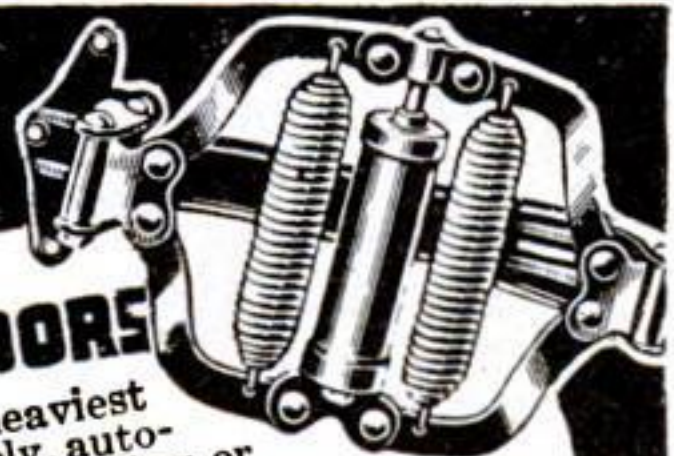
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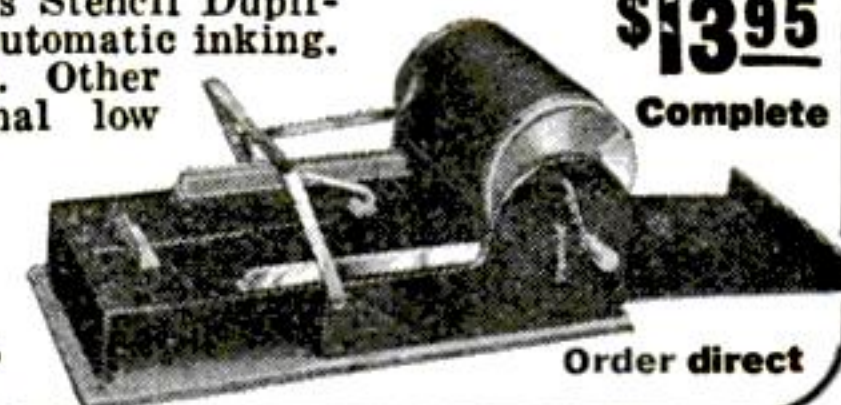
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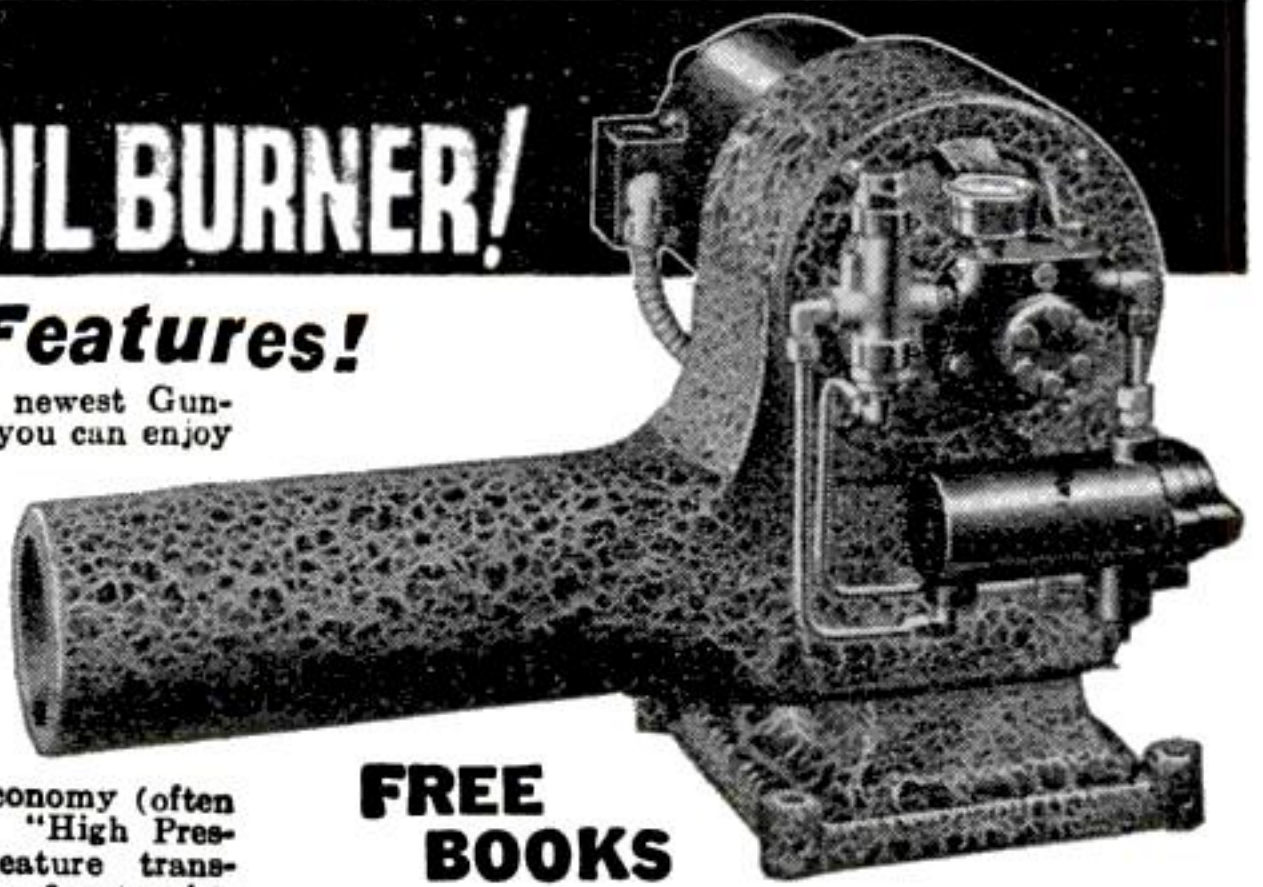
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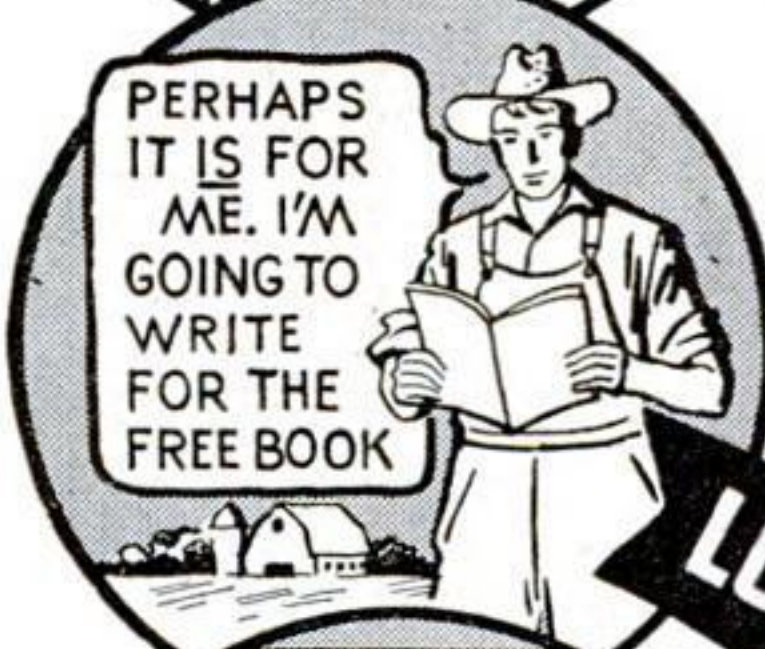
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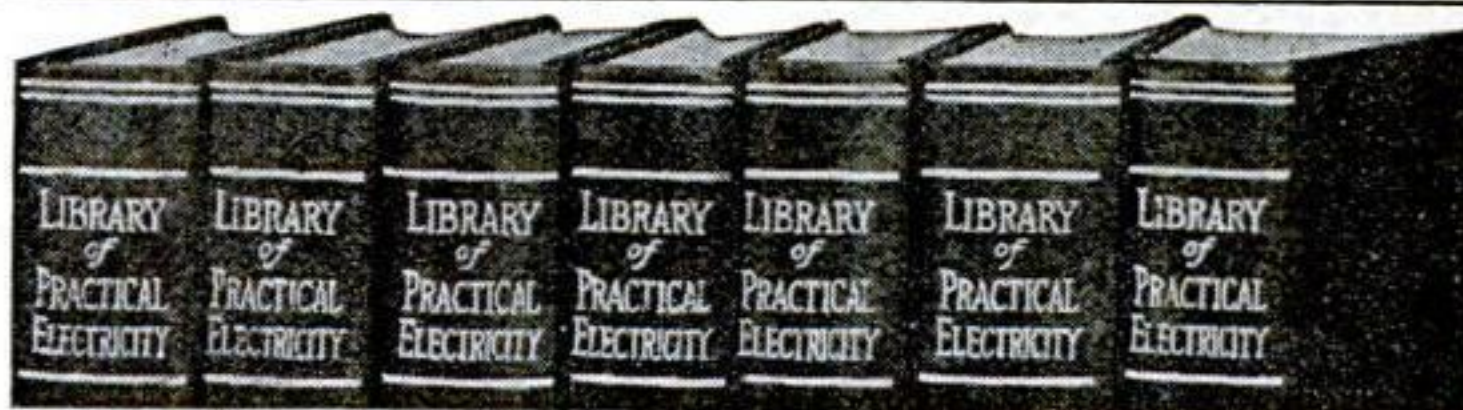
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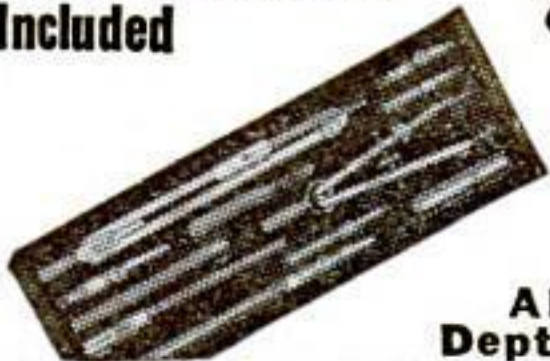
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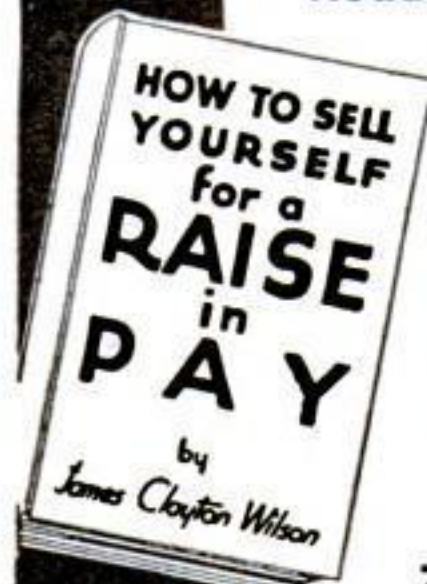
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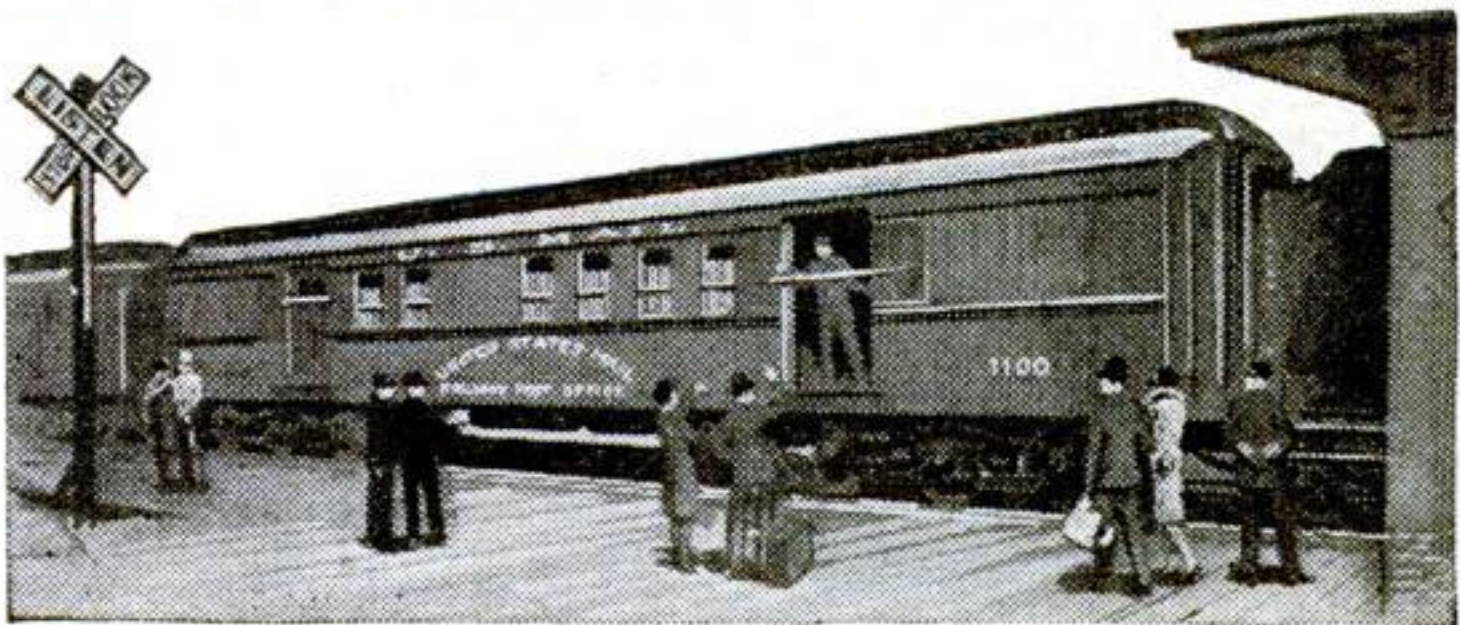
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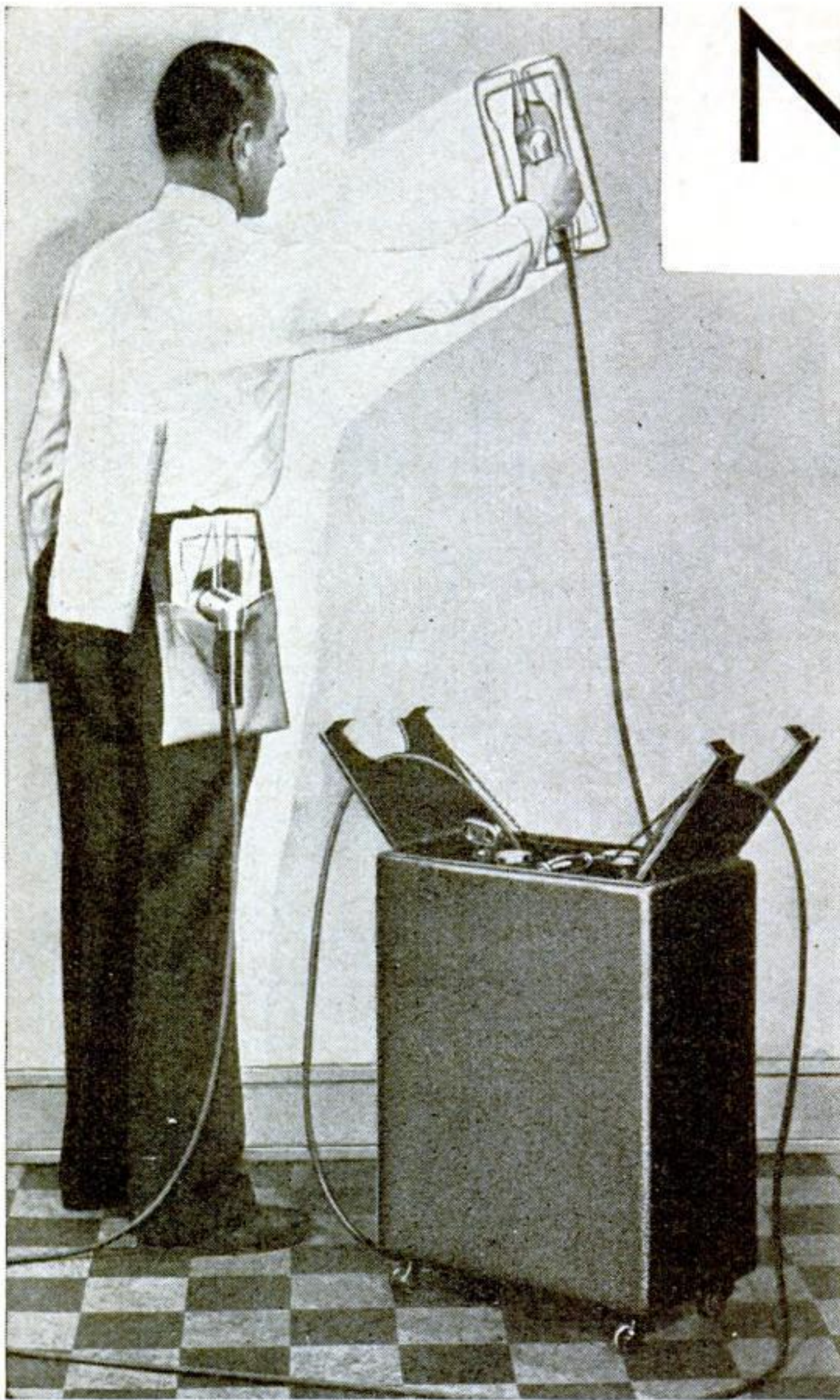
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This machine cleans the dirt from painted walls five times as fast as a man with brush and pail

New Ideas FOR HOME OWNERS

Portable Electric Unit Cleans Painted Walls

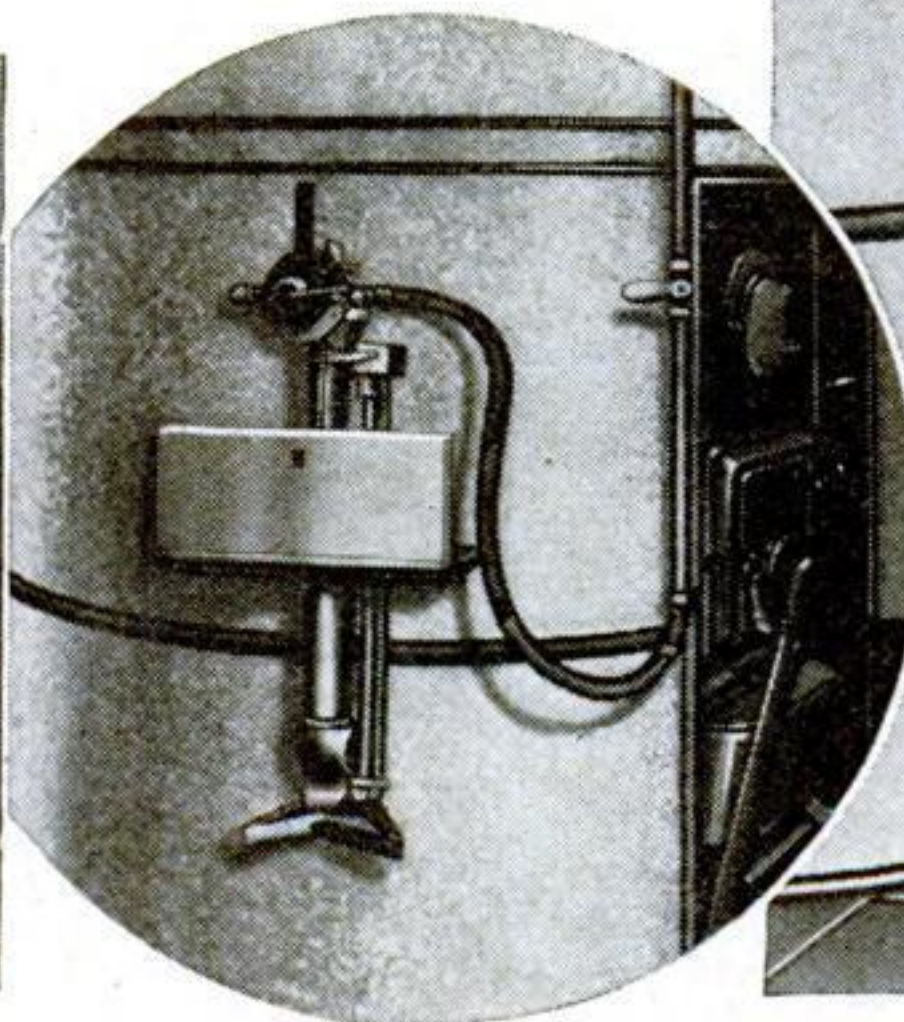
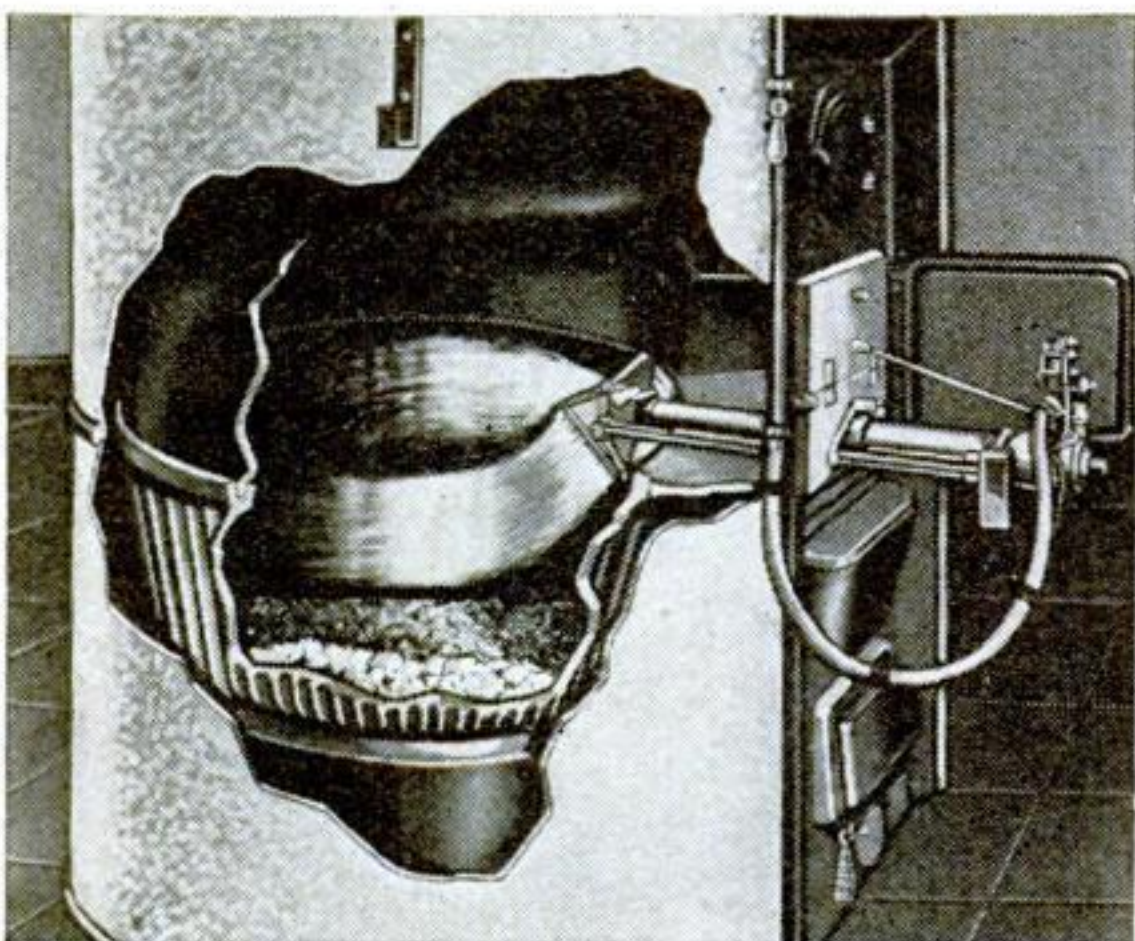
HOUSED in a compact cabinet which can be wheeled easily about a room, a newly marketed machine quickly removes dirt from painted walls. It eliminates the necessity for brushes, pails, and rags. The handy outfit accomplishes its task by means of a specially prepared cleansing fluid, without injury to the paint. One man, using one of the new machines, it is reported, can accomplish as much work as five men using pails and brushes.

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"I USED to think that a man of my income couldn't afford to retire at 55. Yet here I am with a check for \$150 coming in every month as long as I live. I can travel, play, work or loaf, as I please.

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You may not have a lot of money in the bank. Maybe you have only your salary to count on. That doesn't stop you from making sure of a Retirement Income.

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2. A life income to your wife in case of your death before age 55.

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Haven't you always wanted a life income to end your money worries and let you do whatever you please? Maybe you won't want to quit work at 55. Maybe you will. You get your income just the same.

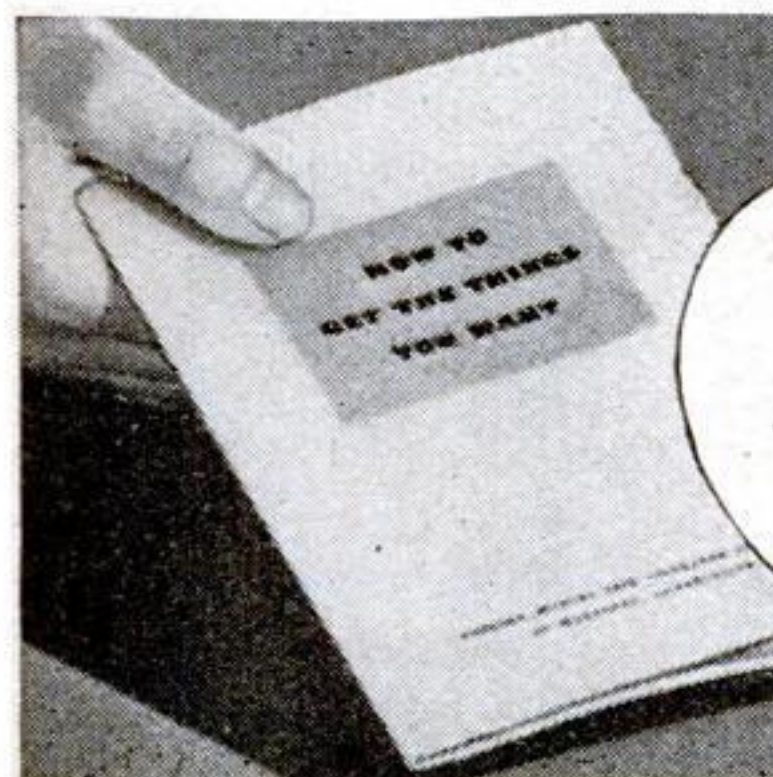
Some men will read this and say, "That's a good plan. I must look into it sometime." Unfortunately, what they don't realize is this: The cost of retirement goes up as a man grows older. The sooner you start, the less you pay.


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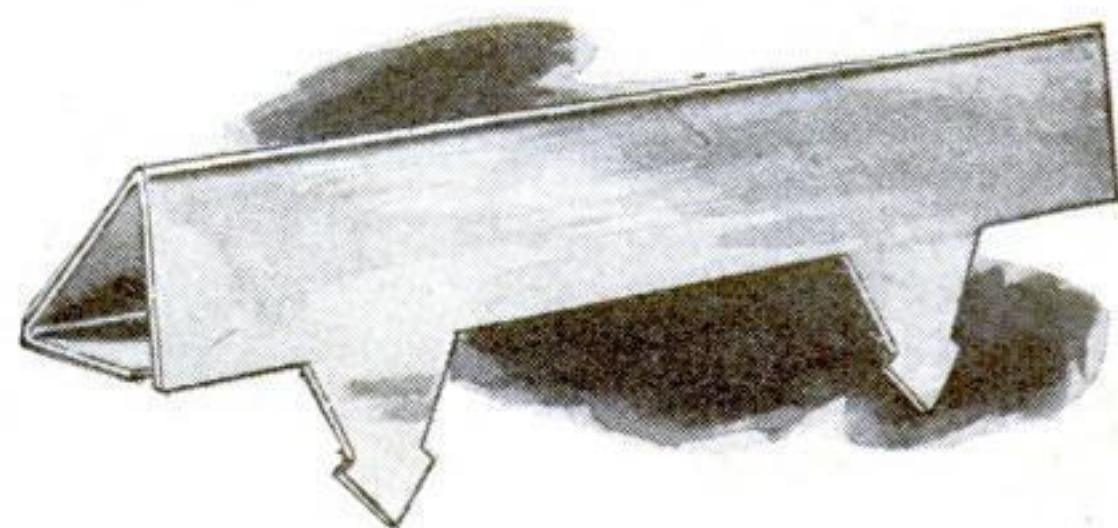
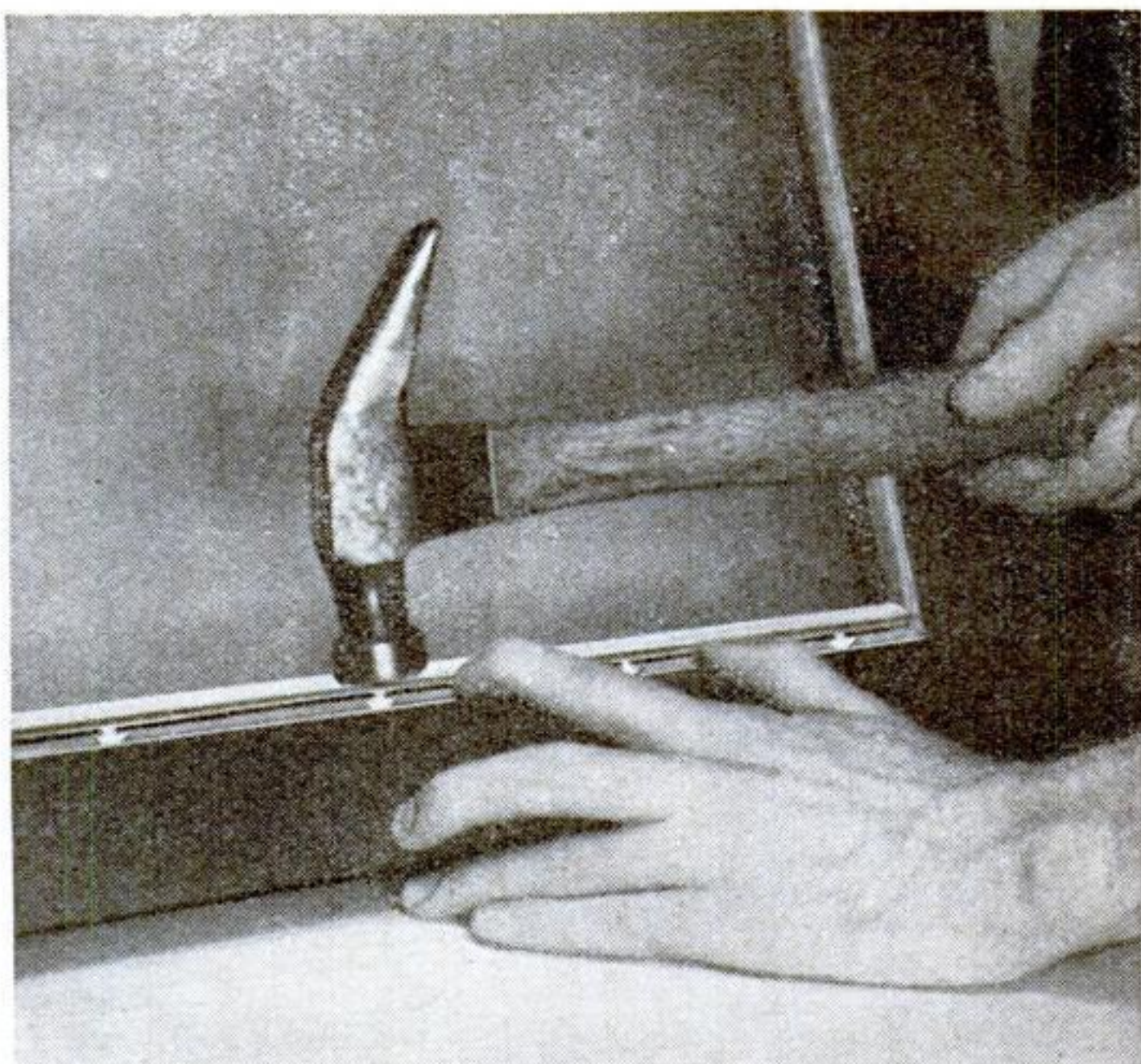
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Extra-Hard Nails Have Many Household Uses

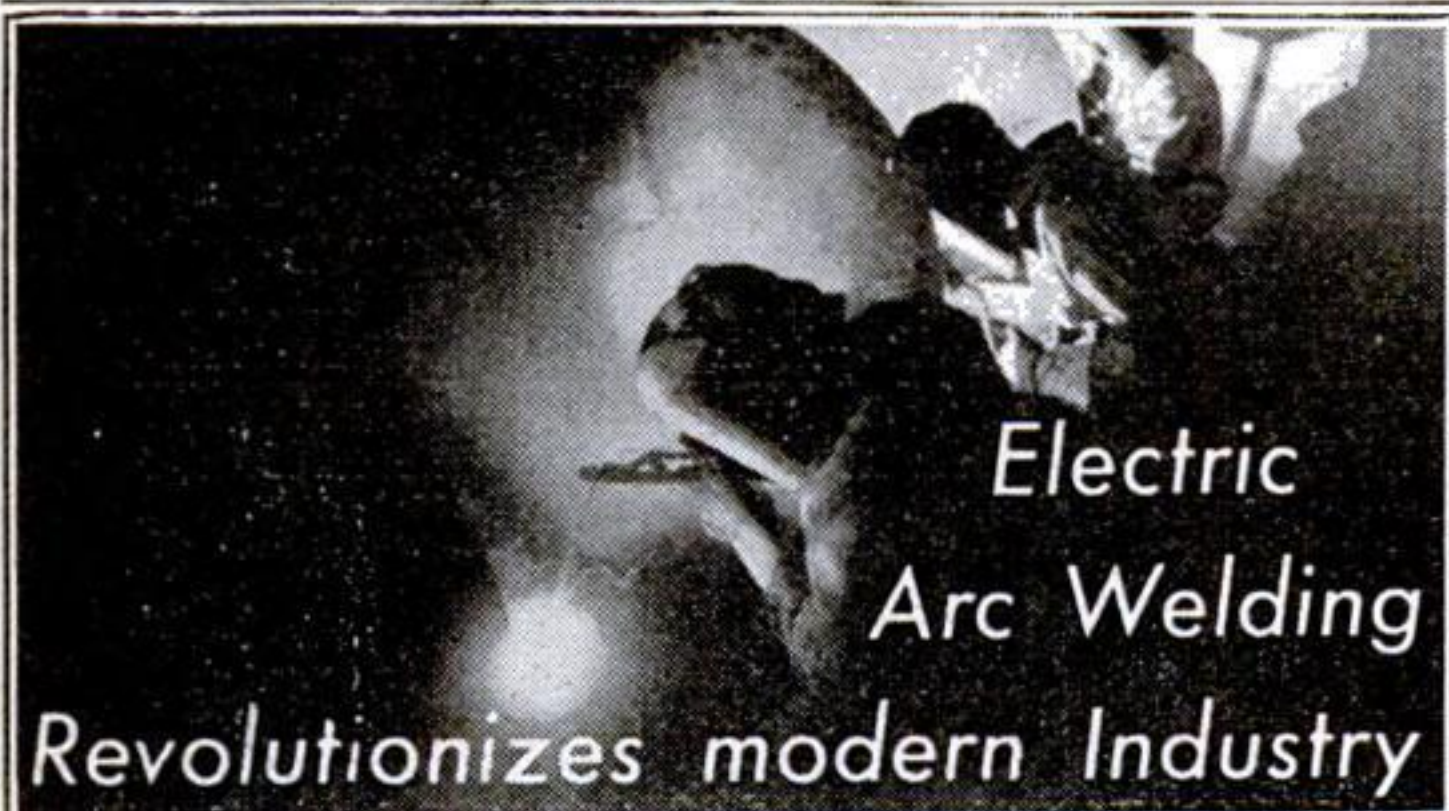
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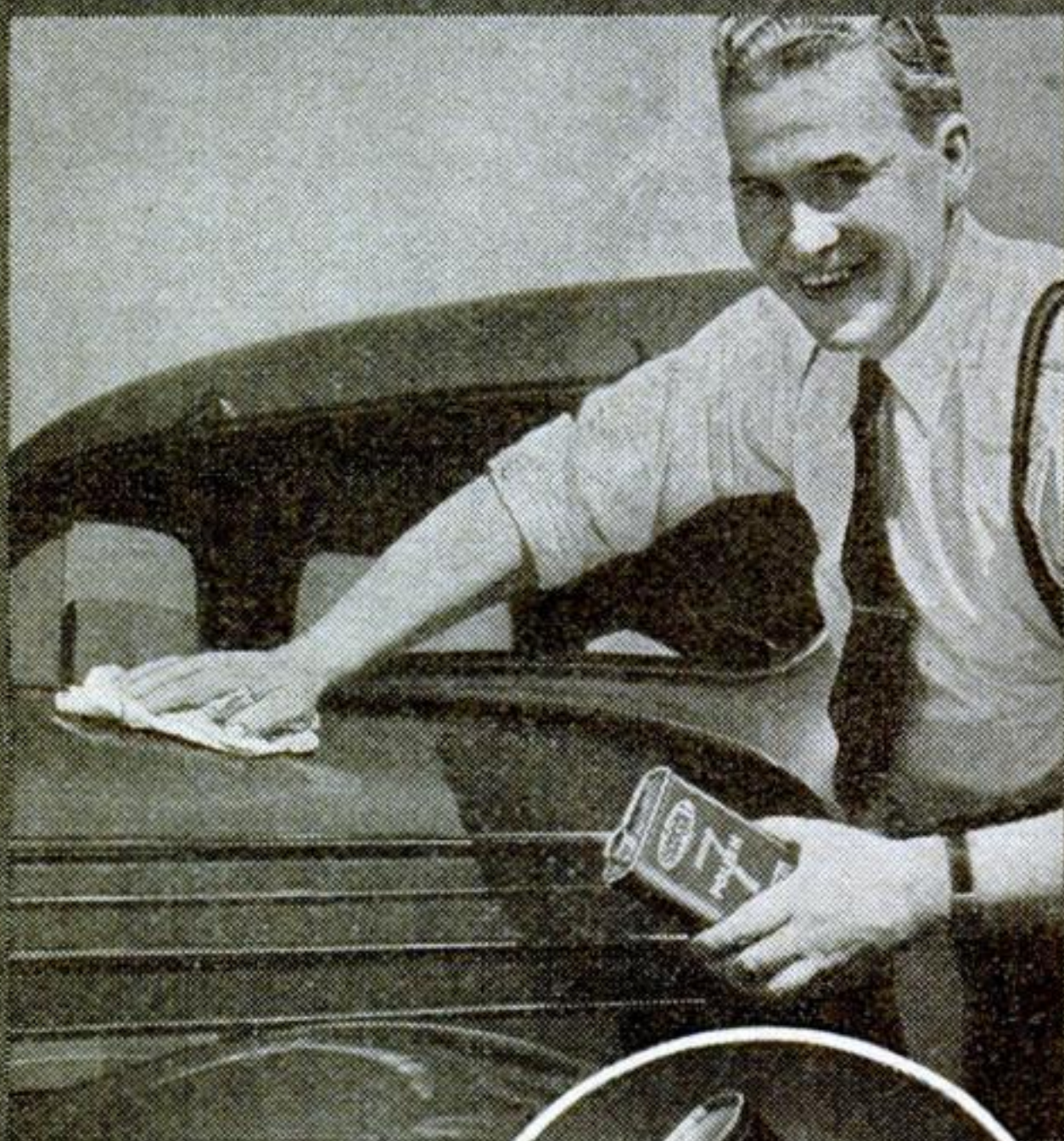
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Questions FROM HOME OWNERS

Q.—I AM planning to build a small cottage, without a basement, and would like to know how deep the concrete foundation walls should be set. A neighbor of mine is putting up a similar building and has made foundation walls that extend only to a depth of six inches below the surface. Is this sufficient for a building of this type?—N.T.S., Detroit, Mich.

A.—ALL foundations should be set at least three, and preferably four, feet below the ground, except where bed rock or another firm base is present. This is necessary as a precaution against frost, which may cause bad cracking in the walls.

Liquid Rug Cleaner

F.P., CLEVELAND, OHIO. A good rug cleaner in liquid form may be prepared by mixing the following ingredients, which can be obtained from a chemical supply house in your vicinity: Diglycol oleate, 44 parts; butylcellosolve, 5 parts; ethylene dichloride, 12 parts; alcohol, 15 parts; oleic acid, 11 parts;

(Continued on page 56)

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your first taste
of VELVET
the smile's too big
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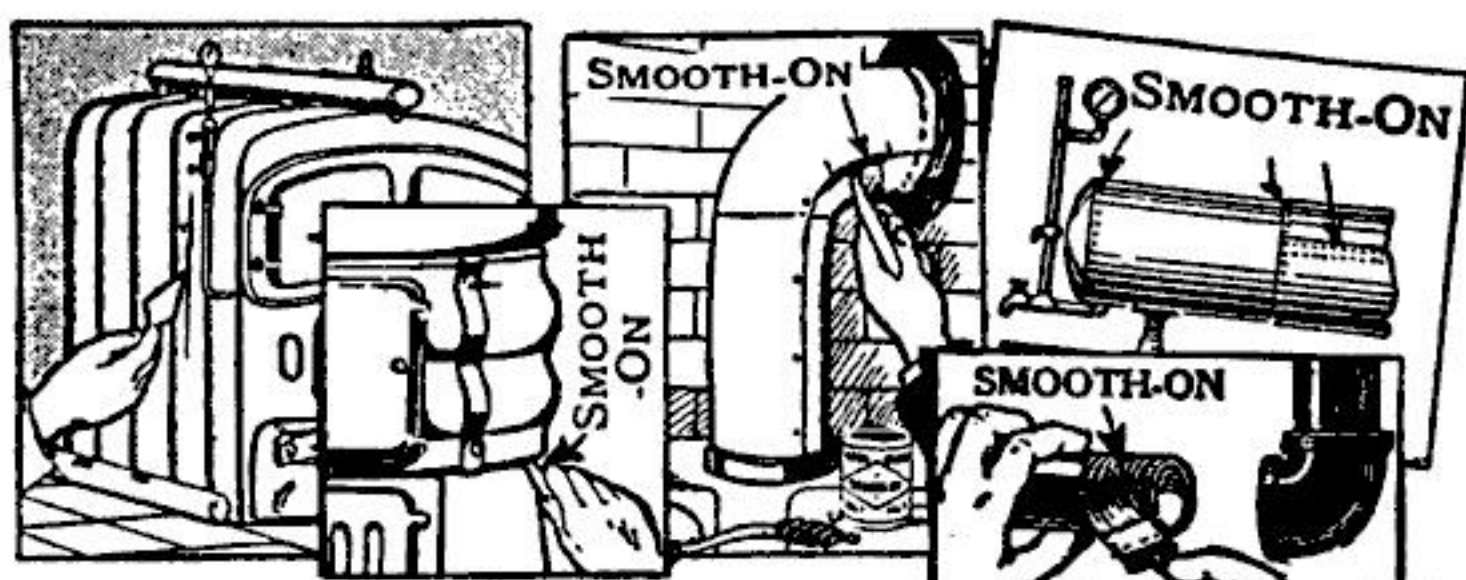
*Velvet packs easy in a pipe
Rolls smooth in a cigarette
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OCTOBER, 1938

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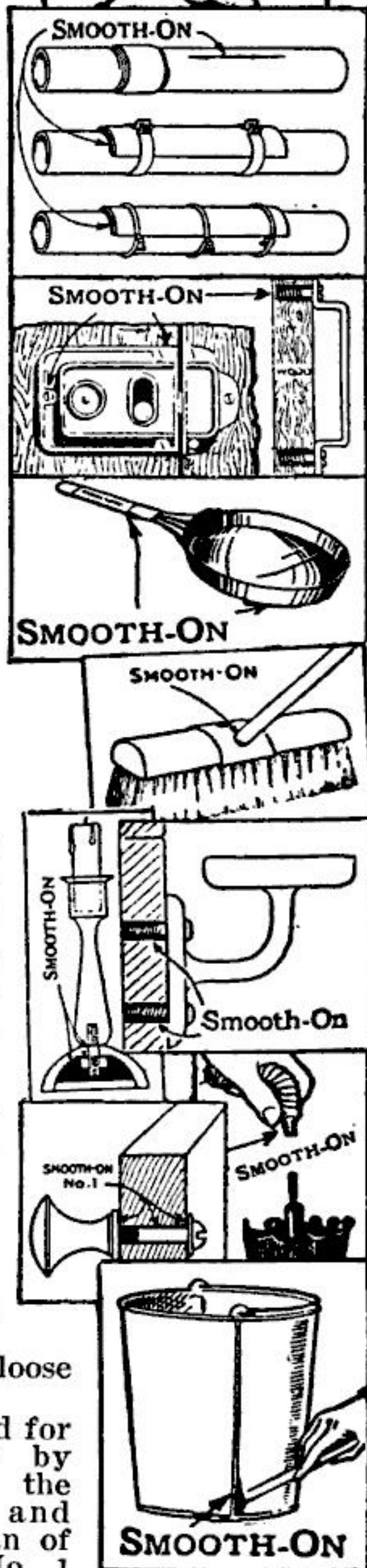
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Questions from Home Owners

(Continued from page 54)

ammonium hydroxide, 11 parts; and water, 45 parts. This product may be made thinner, if desired, simply by increasing the amount of water in the formula.

Cleaning a Brass Bed

Q.—CAN you suggest a good cleaner and polisher for brightening up the dull finish on a brass bedstead? We have tried several cleaners, but with unsatisfactory results.—F.H., Chisholm, Minn.

A.—BEFORE cleaning, brass must be freed completely from any traces of grease, caked dirt, or grime. To do this wash the bed with strong ammonia suds and rinse dry. Then rub the finish with vinegar and salt, or with oxalic acid. Wash immediately after the rubbing, and polish with tripoli powder and sweet oil. Unless the vinegar or acid is washed off, the brass will tarnish quickly. The oil polishing will give a deep-yellow luster that should last for about six months.

Painting a Concrete Floor

H.M., WHEELING, W. VA. If your cellar floor was laid less than a year ago, it should be treated before painting with a wash coat made from a solution of three pounds of zinc sulphate to one gallon of water. This will counteract the alkali.

Wallpaper Cleaners

F.L.W.B., VICTORIA, B. C. Wallpaper cleaners may be prepared by mixing four ounces of powdered pumice with one quart of flour, adding enough water to form a stiff dough. Form the dough into rolls two inches in diameter and six inches long, sew each roll separately in a piece of cotton cloth, and then boil for forty or fifty minutes to make the mass firm. Allow the cleaners to stand for several hours, then remove the crust that has formed on them. Rubbing them over the surface of the wallpaper will remove dirt effectively.

Making Paint Brushes Pliable

F.G., STEUBENVILLE, OHIO. To soften paint brushes that have become hard, soak them for twenty-four hours in raw linseed oil and then rinse them out in hot turpentine, repeating the process until they are clean and pliable. This should put them in usable condition.

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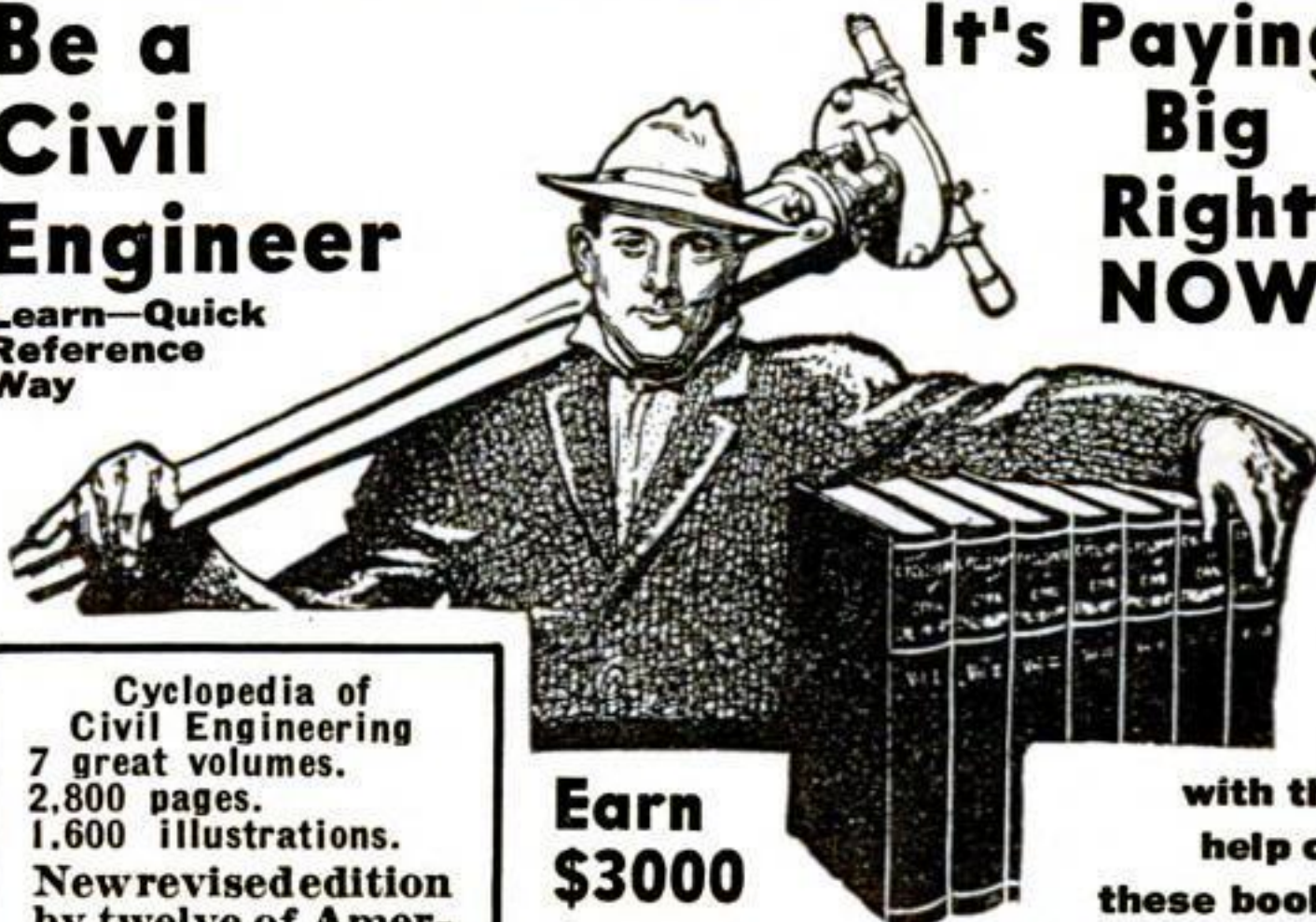
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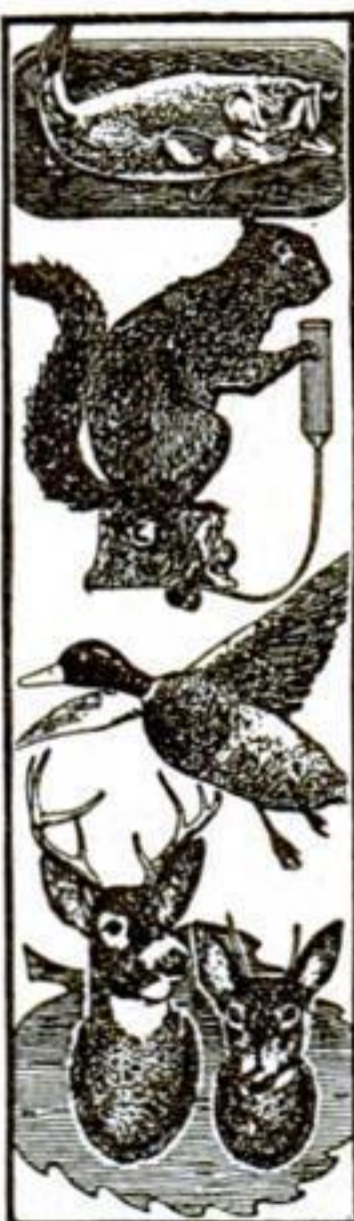
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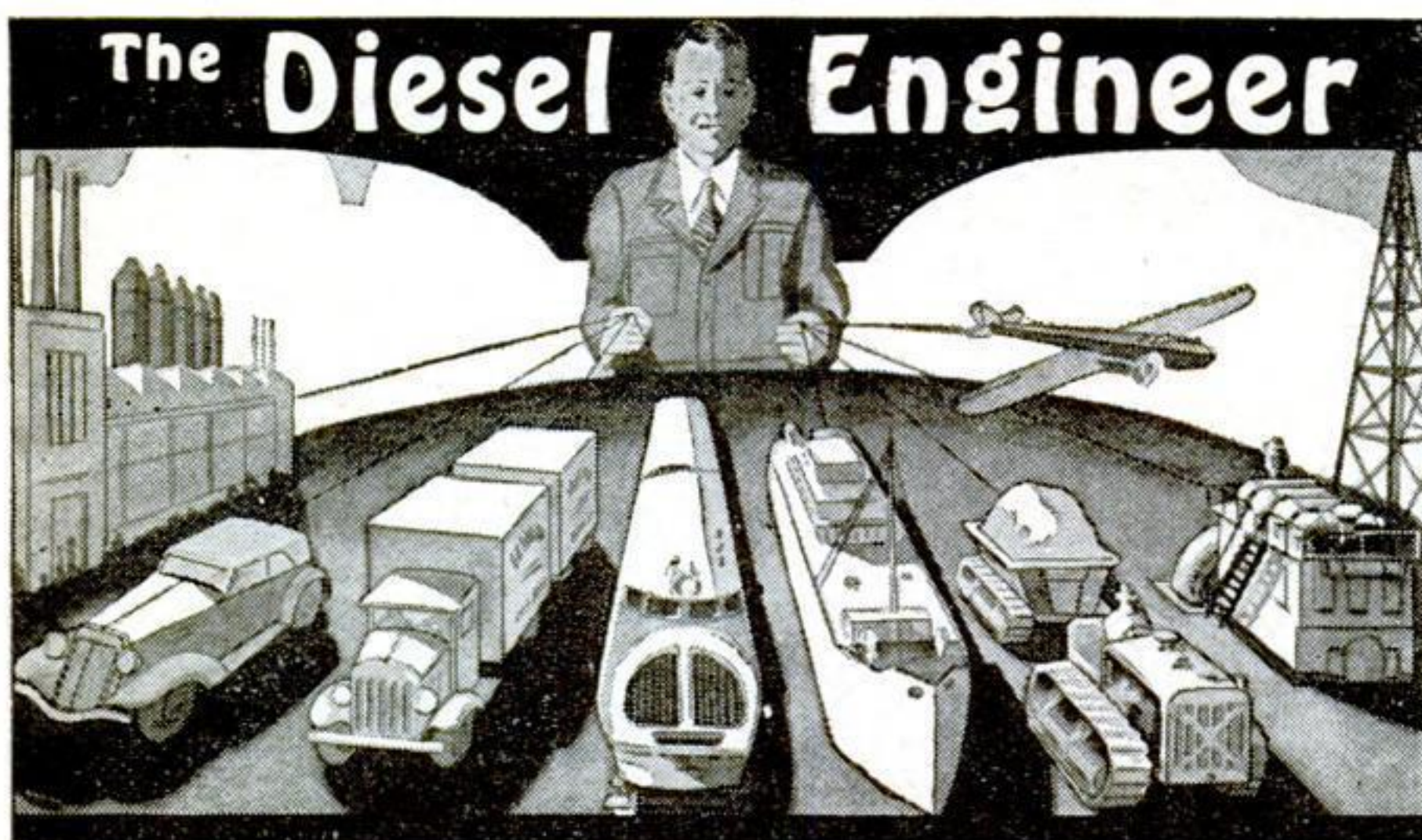
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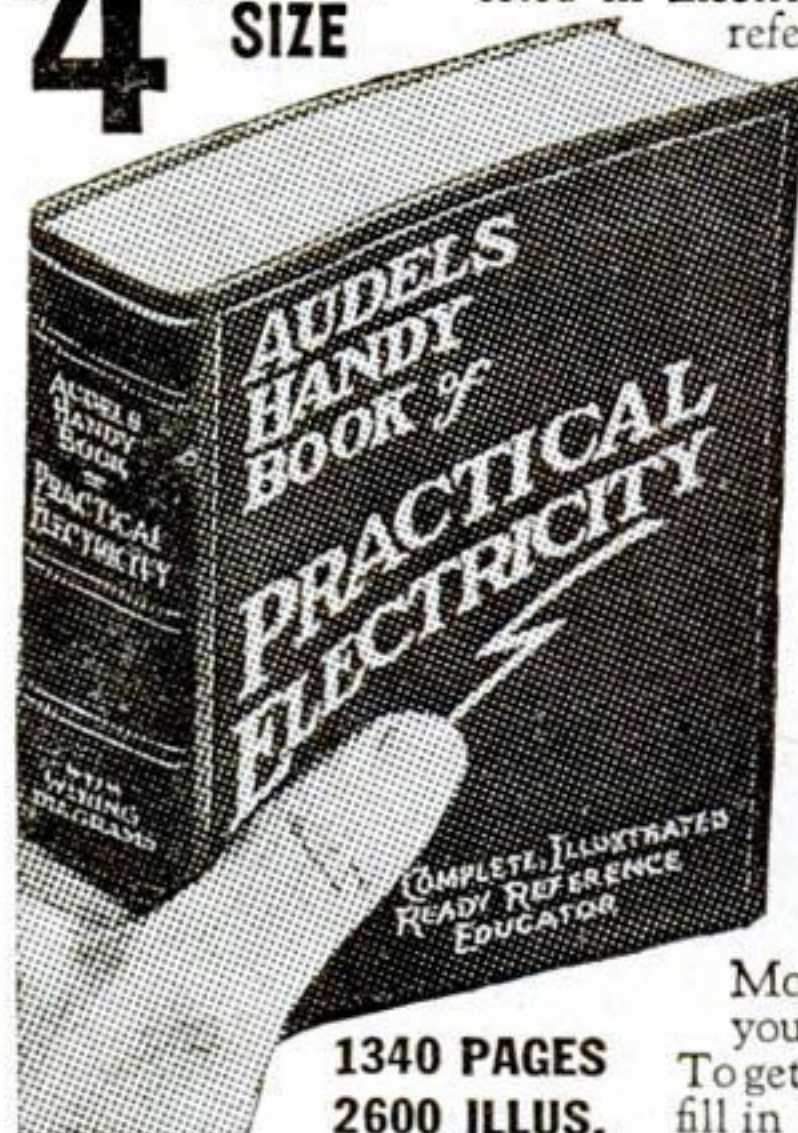
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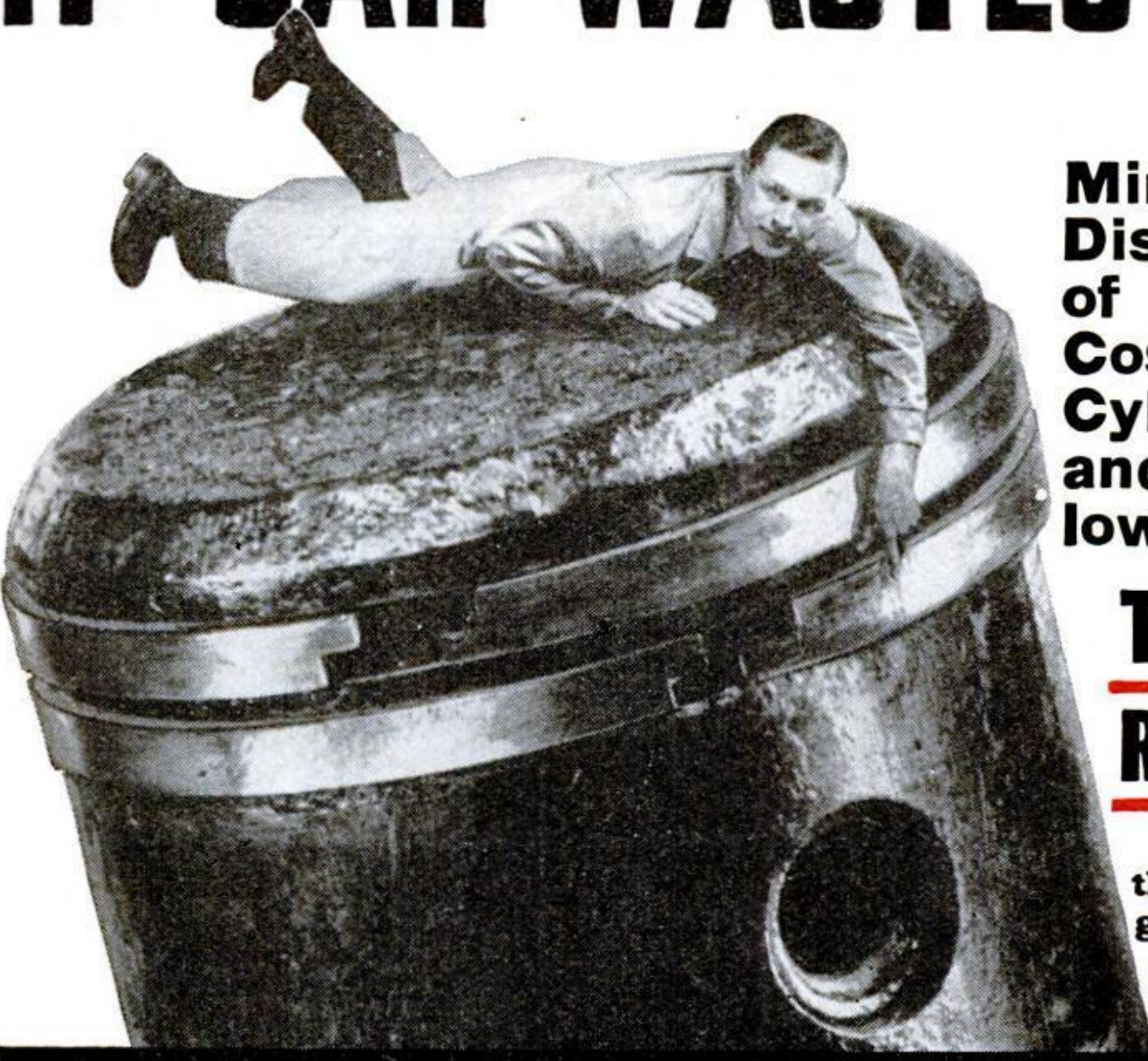
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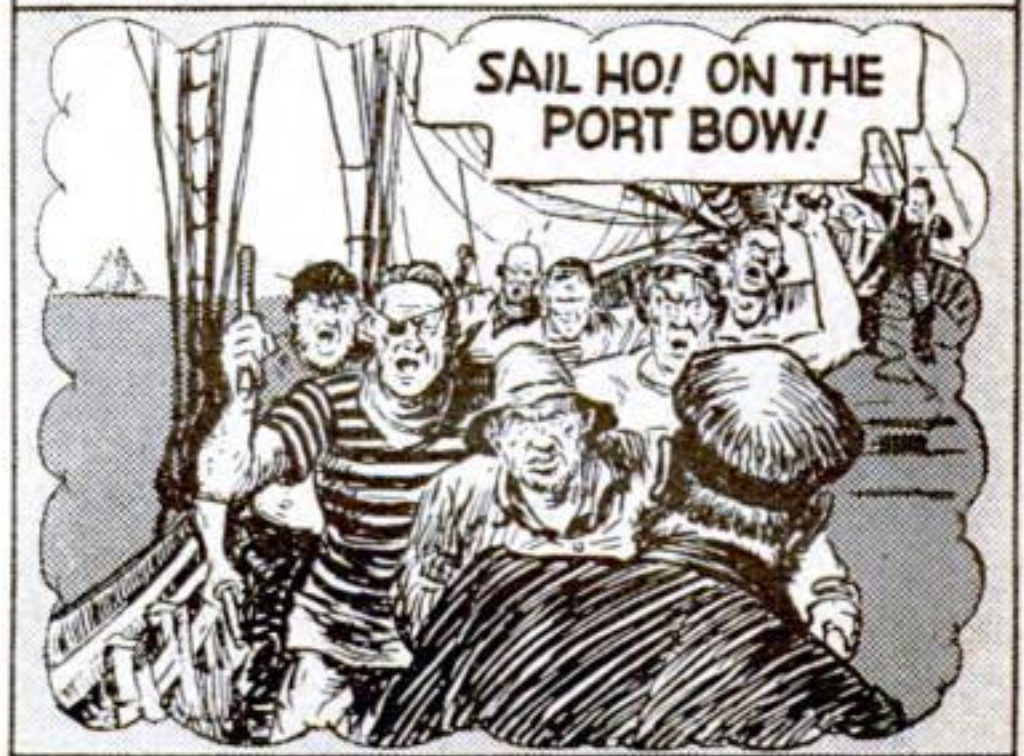
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P.A. IS CRIMP CUT—TWIRLS **FAST** INTO TRIM, **MELLOW 'MAKIN'S'** SMOKES TOO—I GET AROUND 70 TO A TIN



THE **BIG 2** oz. TIN
SO MILD—SO TASTY



50 pipefuls of fragrant tobacco in every 2-oz. tin of Prince Albert

Copyright, 1938, R. J. Reynolds Tob. Co.

PRINCE ALBERT

THE NATIONAL JOY SMOKE

MONEY BACK IF YOU SAY SO

Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage. (Signed) R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

POPULAR SCIENCE

Monthly
RAYMOND J. BROWN, Editor

MANAGING THE *World's Greatest* HARBOR

Meeting place of ships from the seven seas—part of New York Harbor as seen from five miles in the air



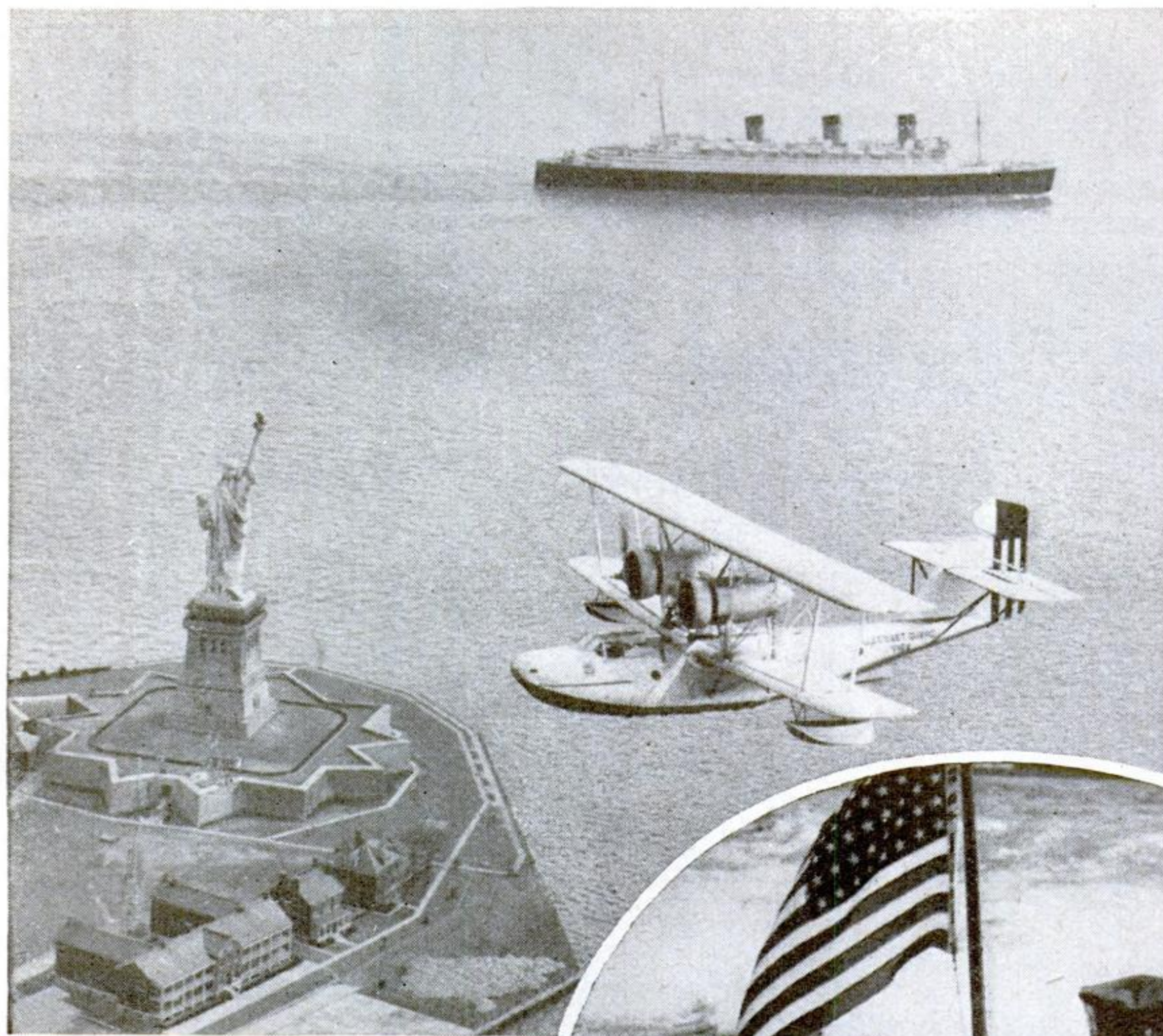
A lighted whistling buoy marking a channel, being hoisted aboard a tender for an overhauling ashore

By JOHN E. LODGE

WHEN the Bermuda-bound liner, *Acadia*, loomed up out of the fog in lower New York Bay a few weeks ago and buried its prow in the side of the crowded excursion steamer, *Mandalay*, passengers of the two ships witnessed a dramatic test of the emergency machinery of a great harbor.

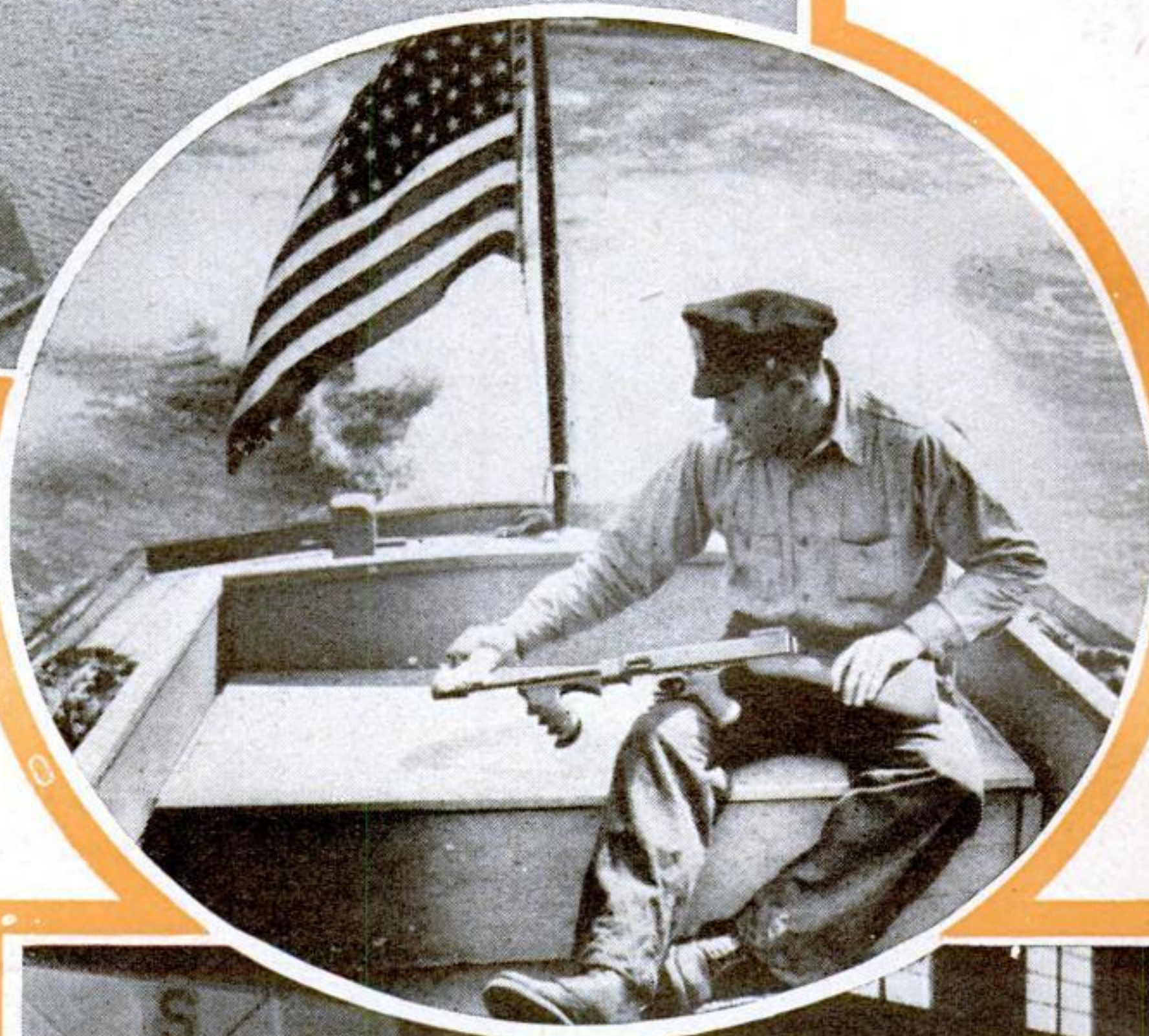
In response to the SOS, high-speed rescue vessels raced across the water—fireboats, swift Coast Guard patrol ships, crack speedboats manned by officers of the harbor police. On shore, radio cars, emergency trucks, and ambulances were as quickly mobilized. The next morning, newspapers told how the cool-headed captain of the *Acadia* had forced the prow of his ship like a cork into the gaping hole in the hull of the excursion vessel, keeping it afloat until every passenger was transferred to safety.

That swift concentration of aid served to demonstrate just one of the many tasks per-



U.S. Coast Guard flying boats help protect sea traffic. The one at left is passing the Statue of Liberty with the "Queen Mary" in the distance

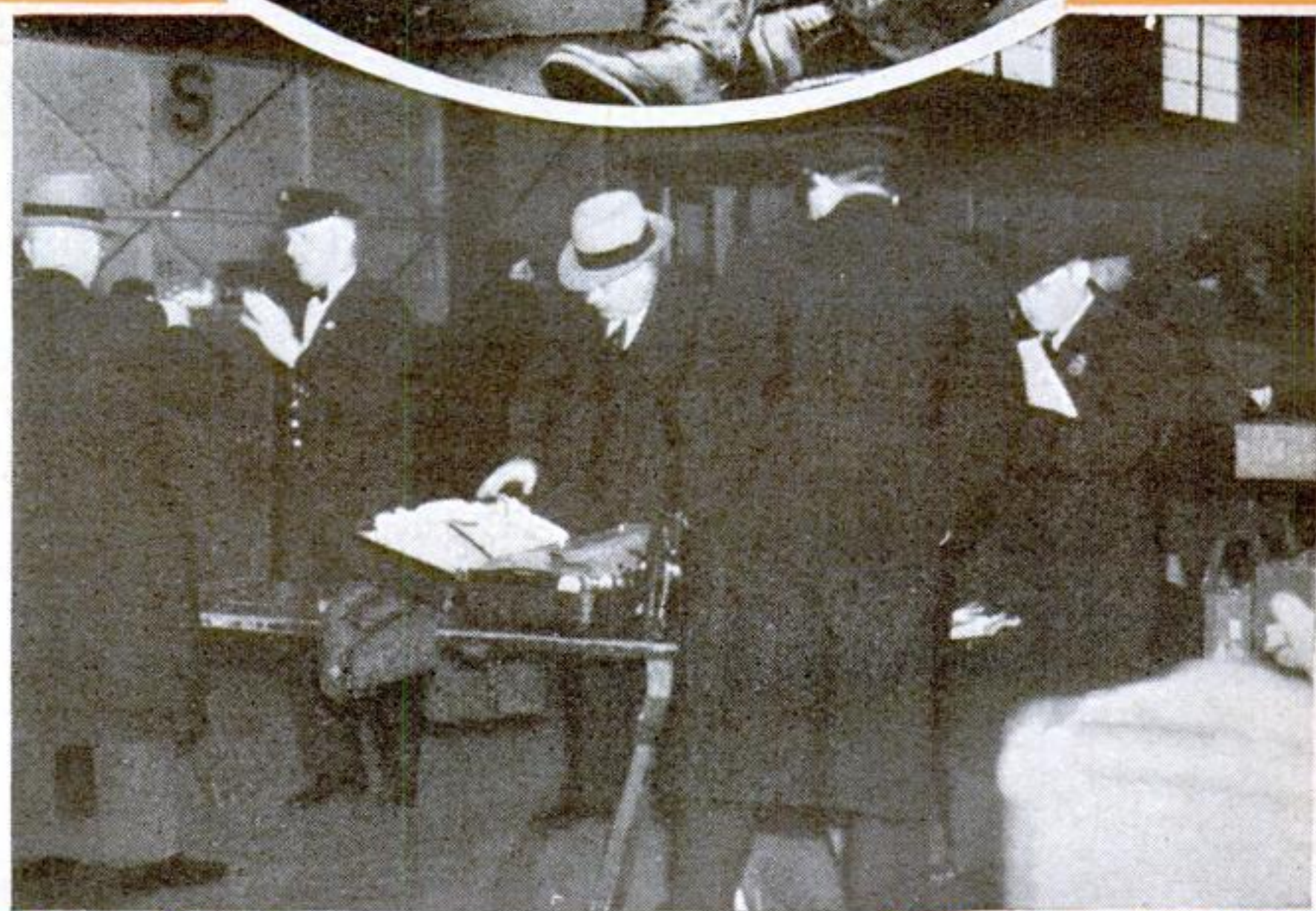
A salt-water policeman on board a harbor-patrol launch polishing up a submachine gun while on duty



formed by the army of men whose job it is to run New York Harbor. For on them rests the responsibility of making this ocean terminal the safest as well as the largest and busiest seaport in the world.

Picture a harbor so large that 164 cities and municipalities, with a total population exceeding 11,000,000 people, border its 771-mile shore line. Picture a maritime center with a water area of 1,500 square miles—larger than the whole state of Rhode Island—and you have some idea of their task.

Spreading out like a giant octopus, its seven sheltered bays and four rivers present a management problem that requires the combined efforts of more than a dozen agencies. Supervised by the U. S. War Department, men of the Coast Guard, the Lighthouse Service, the police, the Army Engineer Corps, the U.S. Coast and Geodetic Survey,



Customs officers examining the baggage of incoming passengers at one of the docks. Efficient organization gives ships quick turn-arounds

and various municipal organizations coöperate to make New York a harbor second to none.

On the lower tip of Manhattan, at the Battery, the 157 picked men of the harbor police have their headquarters. Manning sleek 225-horsepower speedboats equipped with two-way radio, machine guns, and powerful searchlights that can pierce a mile and a half

through the darkness, they help small boats in distress, rescue victims in collisions, aid in enforcing the rules of navigation, and guard the harbor's 1,822 piers and wharves from waterfront thieves.

Near-by at Floyd Bennett Field, one of the twenty-one modern airports and seaplane bases that serve the harbor, a U. S. Coast Guard station houses fast planes and speedy

cutters that are held in readiness for every sort of emergency from warning small craft of impending storms to clearing the harbor of ice. When the *Mandalay* sank to the bottom after its collision with the *Acadia*, a Coast Guard seaplane and a cutter raced to the scene and guarded the wreck until a lighthouse tender arrived and placed marking buoys to warn the harbor traffic.

Laying buoys to mark wrecks, however, is just one of the minor tasks performed by the men who man the boats of the U. S. Lighthouse Service. More than 10,000 ships a year, carrying goods worth \$10,000,000,000 must be guided safely through the deep channels of the harbor's



Floating ice often fills the Hudson River. Here the Coast Guard cutter "Mohawk" is clearing a path through

bays and rivers. To do this requires more than 600 buoys, and each must be cleaned, painted, and repaired periodically.

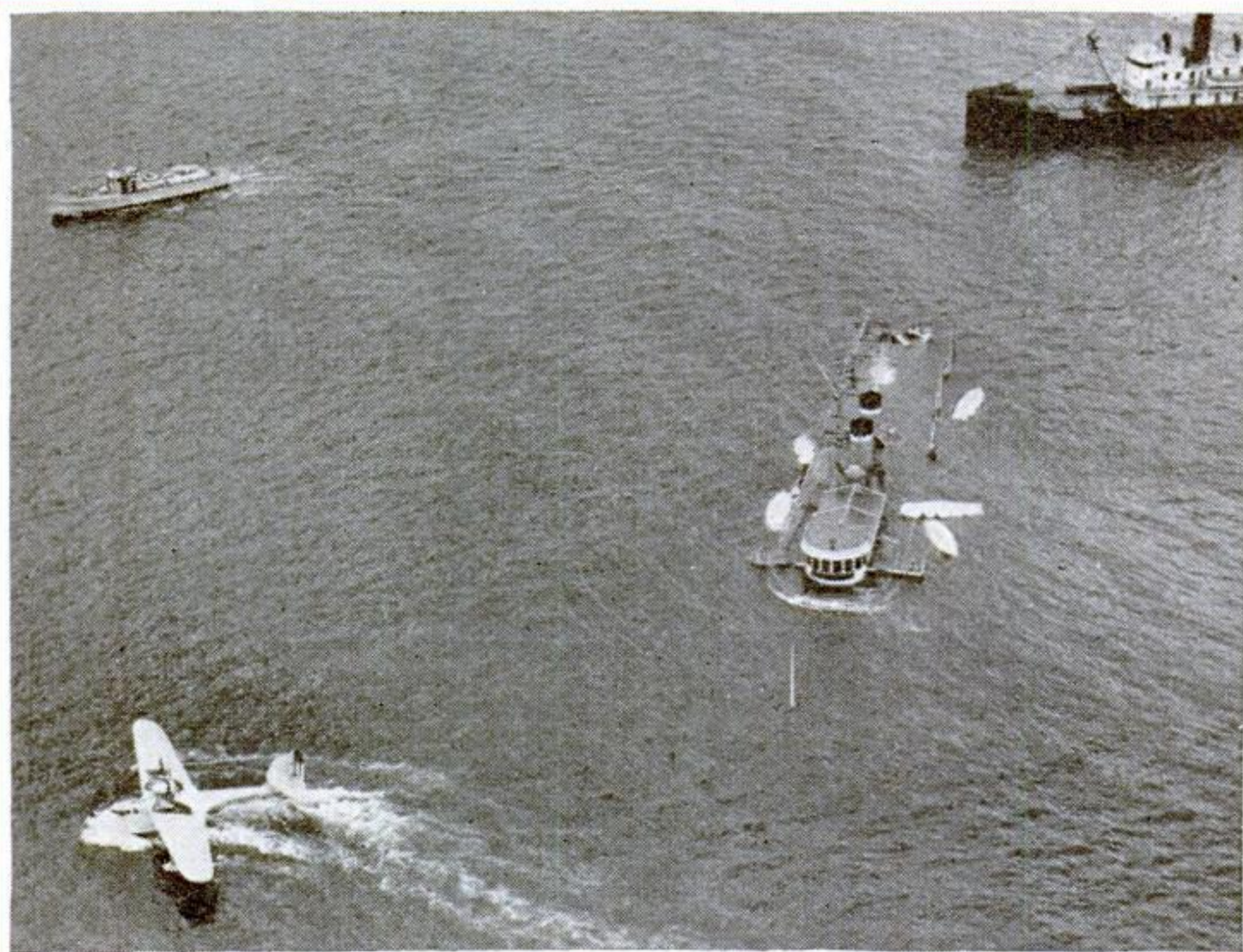
A fleet of War Department dredges works

almost continuously to keep these channels deep enough and wide enough to accommodate giant ships like the *Queen Mary* and the *Normandie*. Last January the giant dredge

Goethals began the two-year job of removing 15,000,000 cubic yards of muck and silt from one of the channels in the outer harbor. Future plans call for a deepening and widening of the main Hudson River channel to a minimum depth of forty-five feet and a width of 2,000 feet to provide ample room for the English and French superliners to be swung about by tugs in midstream.

Working in conjunction with the dredges, ships of the U. S. Coast and Geodetic Survey plot the shape of the harbor's bottom. Through the use of sensitive depth-measuring instruments, the so-called Hudson River Gorge, a natural channel running out from the harbor, has been so accurately charted that the navigator of a ship equipped with a fathometer can plot his position accurately merely by taking depth soundings.

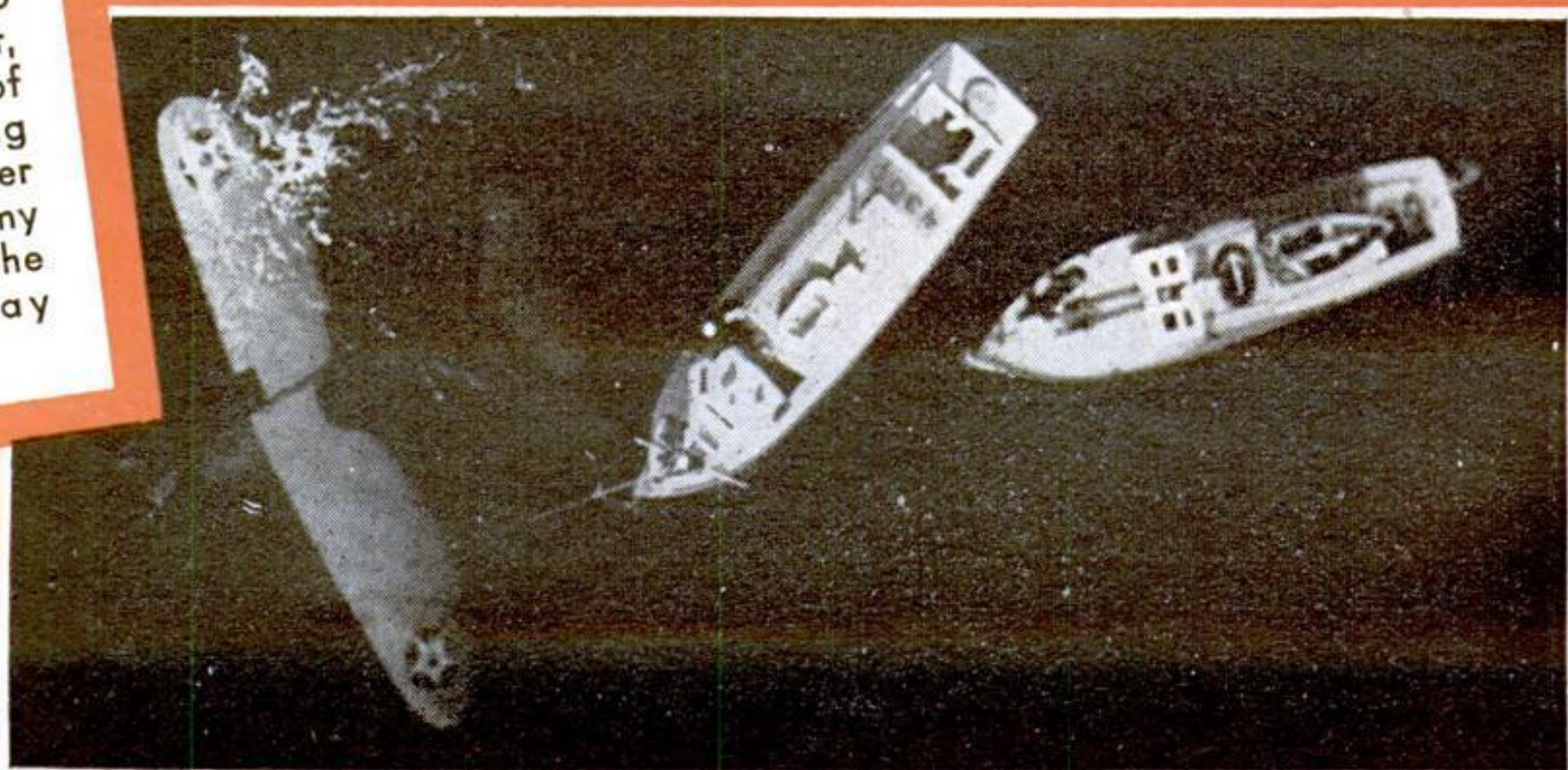
Every modern aid available is used to speed the world's ships to their New York



When this excursion steamer (right center) sank, a Coast Guard cutter and seaplane guarded the wreck until a lighthouse tender arrived to lay buoys



Queer jobs of the harbor patrol: Above, a dead whale is being towed out to sea to be destroyed. Right, a bird's-eye view of a police boat helping a Coast Guard cutter to salvage a U.S. Army plane that fell into the water of the bay





One of the thrilling sights of the harbor is the docking of a giant liner. Here the "Queen Mary" is being eased into her slip by an army of tiny tugs. Some drag hawsers at the stern, and others shove the bow

docks. From the towering spires of radio antennas spotting the harbor, messages flash through the ether to guide the scurrying craft. Many of the fleet of 700 tugs that ease the giant liners up to their piers are radio-equipped, and a special radio circuit interconnected with the city's public telephone lines provides them with constant two-way telephone communication with their land headquarters. This service is also available to other commercial craft and private boats.

Radio has even eliminated the stop at Quarantine which formerly delayed incoming ships for several hours. The new plan, in effect a little more than a year, makes the ship's doctor an unofficial health officer. If his ship has a clean bill of health, he reports by radio while he is still twelve miles at sea. Once the liner has received its radioed permission, it can proceed directly to its dock.

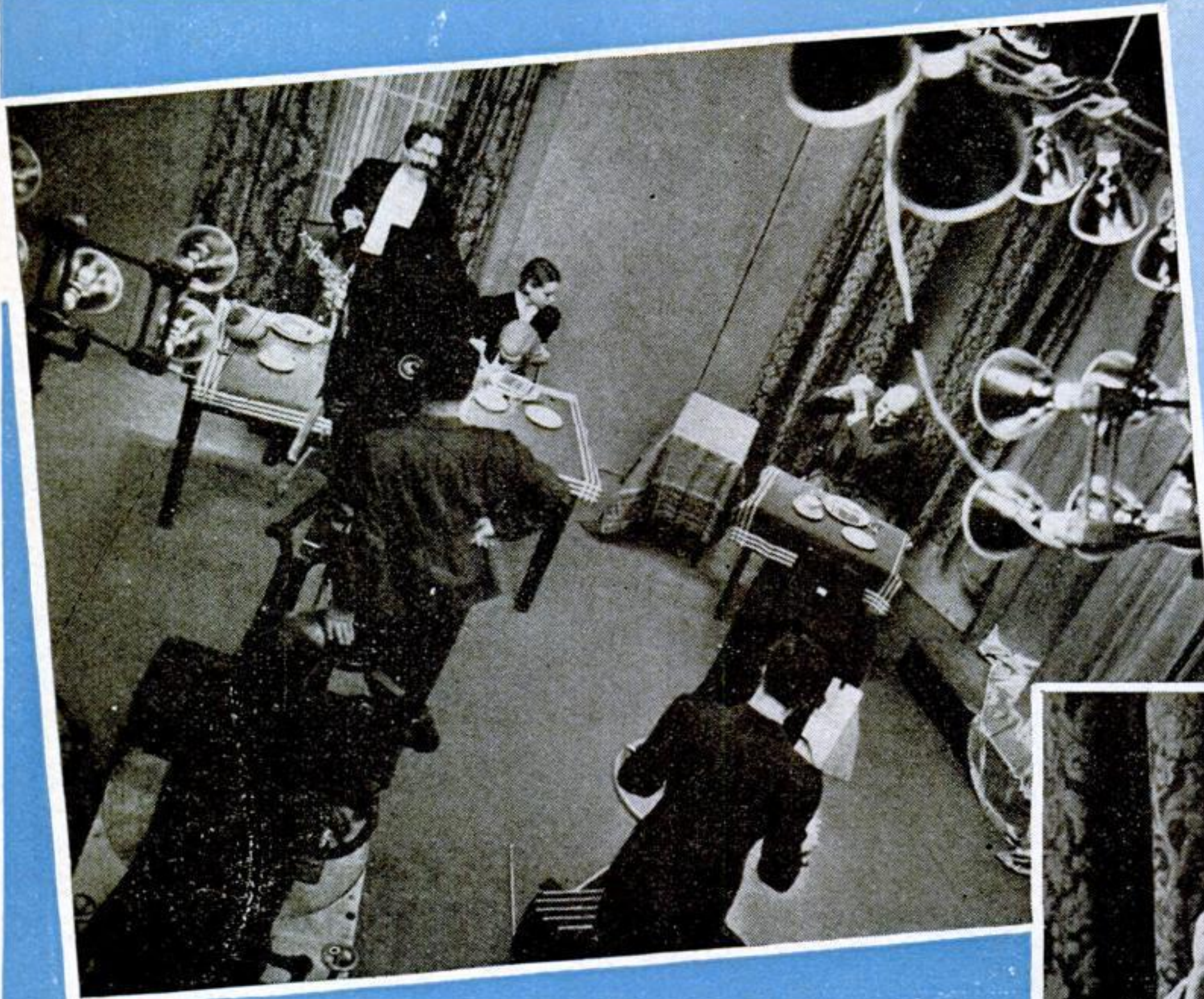
To handle the 120,000,000 tons of waterborne freight that passes through New York Harbor in the course of a single year, a vast army of 250,000 longshoremen, stevedores, and truckers are often kept working day and night. More than \$1,000,000,000 has been invested in the wharves, warehouses, dry docks, and other harbor equipment with which New York serves more shipping than London, Kobe, Yokohama, or Rotterdam.

On the western shore of the harbor, at Greenville, N.J., the Pennsylvania Railroad maintains one of the busiest freight terminals in the world. At its 2,000-foot pier, five freight cars at a time can be run onto "floating bridges," great barges that transport them to other shore points on the many bays and rivers of the harbor.

Besides the piers and railroad terminals, 40,000 factories, fifty floating docks, forty-seven shipyards, and an infinite variety of smaller enterprises cluster along the harbor's shoreline. Plumbing through the mud of the bottom are a maze of water mains, oil pipes, power lines, and telegraph cables.

A spider web of tunnels carries subways, railroads, and automobile traffic under several of the harbor's rivers, while a network of bridges provides additional connections between New York's five boroughs and to neighboring New Jersey. Thus, New York Harbor comprises within itself a vast transportation system.

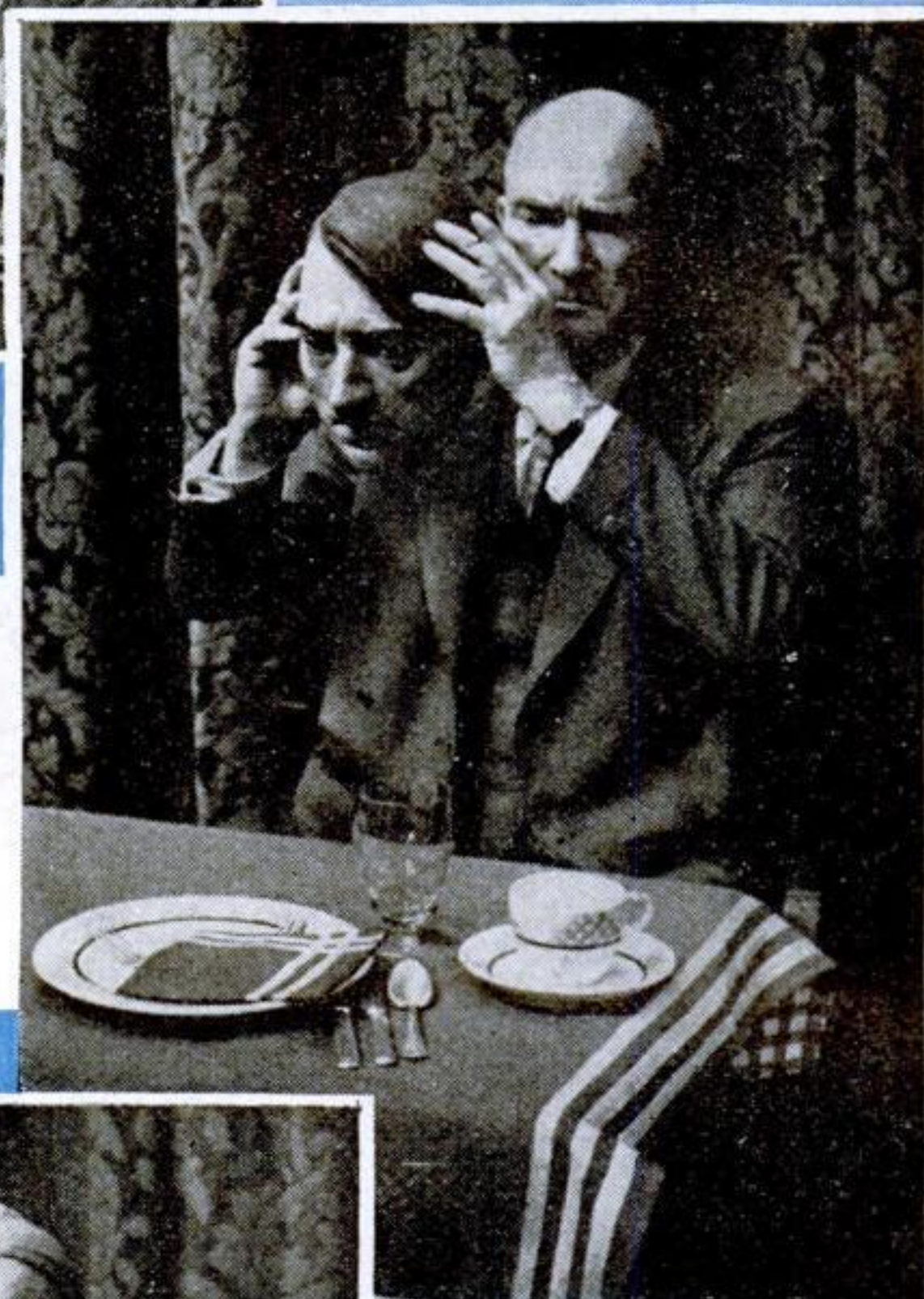
Caring for these arteries of traffic and for the endless stream of ships that come to New York from every corner of the globe is an industry that employs hundreds of thousands of men in a wide variety of specialized jobs, and one that brings to the United States millions of dollars in revenue.



Wearing Humorous Masks and Aping the Voices of a Group of Famous People, Actors Put on a Banquet Scene as a Comic Television Stunt

Lifelike Face Masks Used In Television

FACE masks representing a number of prominent political figures, leaders in government, and well-known motion-picture stars were worn by actors in a comedy skit that recently featured a television program broadcast from the National Broadcasting Company's experimental station in New York City. Use of the facial caricatures before the television cameras had raised doubt that the results would be satisfactory. However, the novel masks, modeled from a silk and wood-pulp combination, televised with exceptional clearness, even without the make-up generally used on the faces of living television actors. During the skit, the masked actors staged a comedy banquet scene.

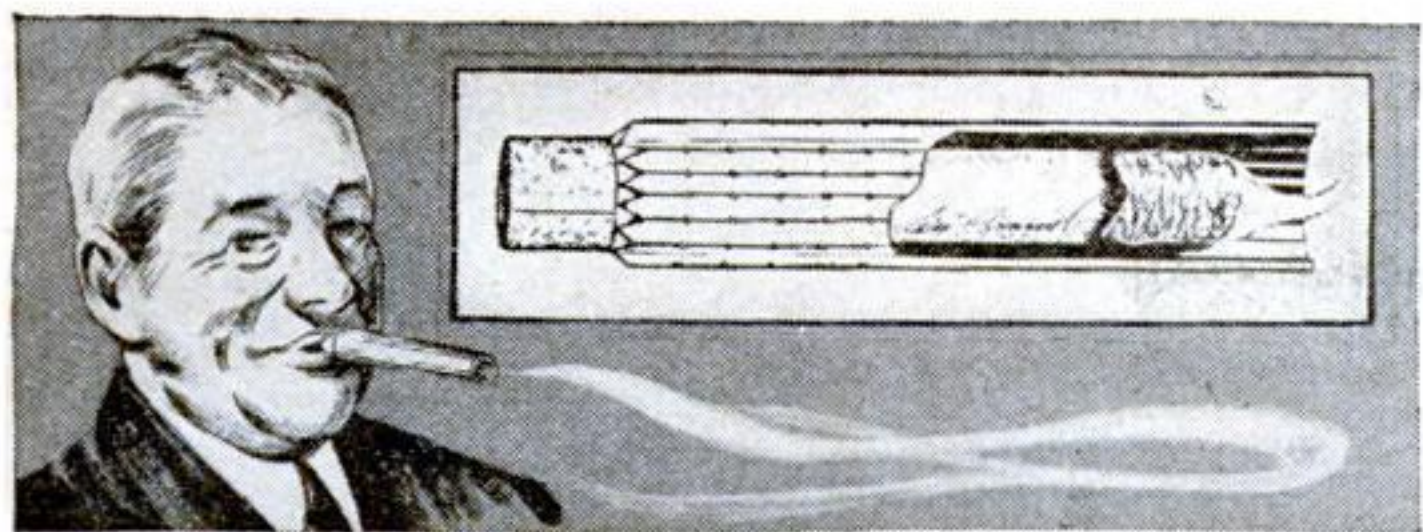


He's not really two-faced, but this actor didn't mean all he said to . . .



. . . his well-known dinner partners shown above and at right. Recognize them?





Cigarette Is "Fireproof"

TO REDUCE the danger of starting fires by dropping cigarette stubs or live ashes on inflammable materials, Charles S. Finnell of El Paso, Tex., recently invented the "fireproof" cigarette illustrated above. Fitted with a cork tip, a perforated shell of fireproof material completely covers a conventional cigarette, shielding the butt when it is thrown away.

Handlebar Baby Carriage

BABY CARRIAGE and bicycle are combined in one odd vehicle devised by Emile Eberle, of Geneva, Switzerland. The rumble seat for infants is fitted onto the handlebars of the bicycle, a metal supporting frame being fastened to the axle of the front wheel.

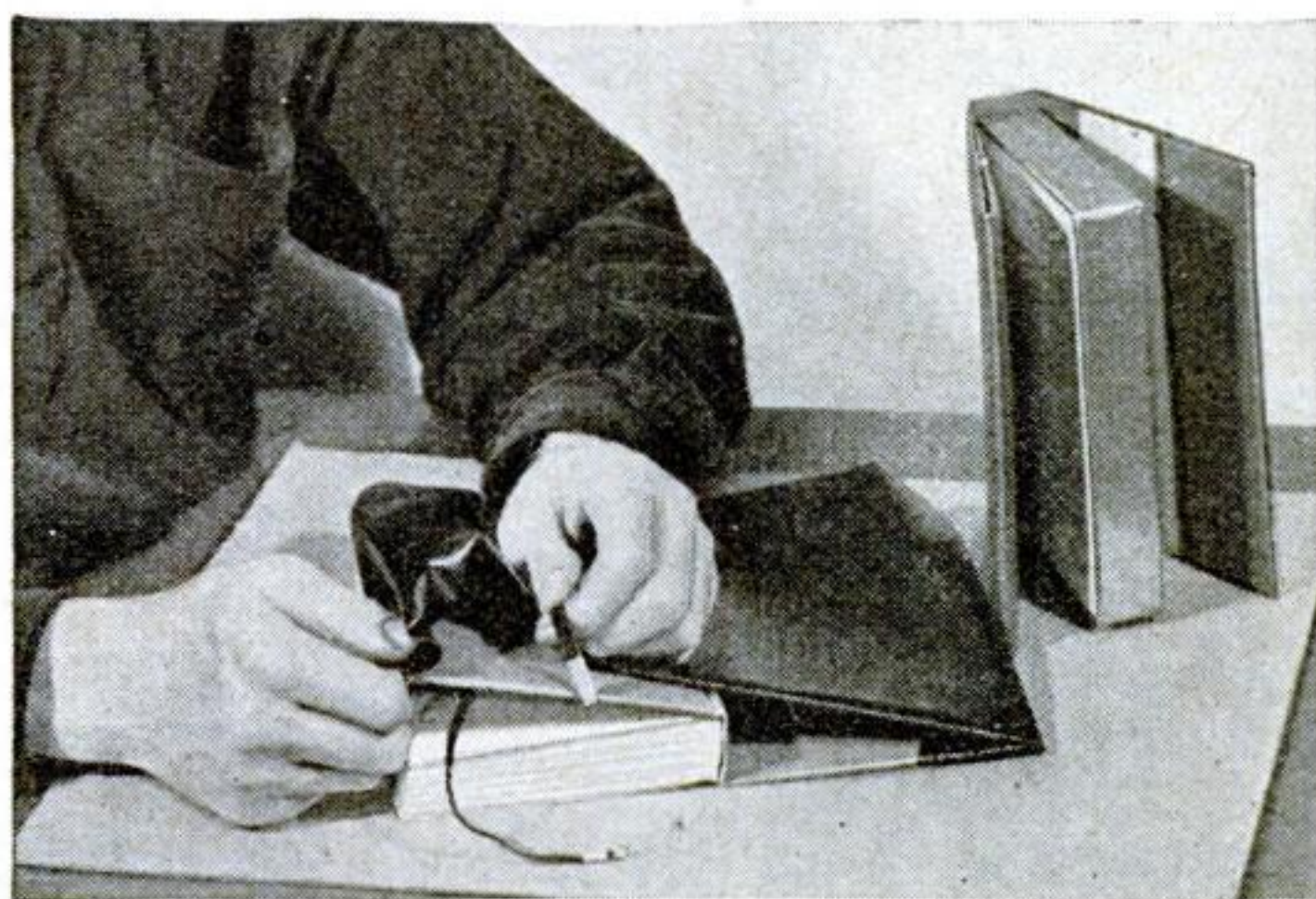
Emile Eberle taking the baby for an airing in his ingenious bicycle carriage



Light bulbs, mounted on finger rings as at left and powered by a battery worn on the wrist, make night signals visible

Lights Show Hand Signals

BATTERIES strapped to the wrist operate an electric hand signal for night driving. Red and white bulbs fit into sockets supported by rings on two fingers of a driver's left hand, making it easily visible when signaling a turn or stop.



Adjustable Book Cover Fits Any Size Volume

ADJUSTABLE to fit volumes of different sizes, a new book cover made of waterproof material has an ingenious arrangement of hook-tipped elastic bands to hold it firmly in place. When the cover is folded to the size of a particular book, the bands are hooked to the edges of the binding as shown above.



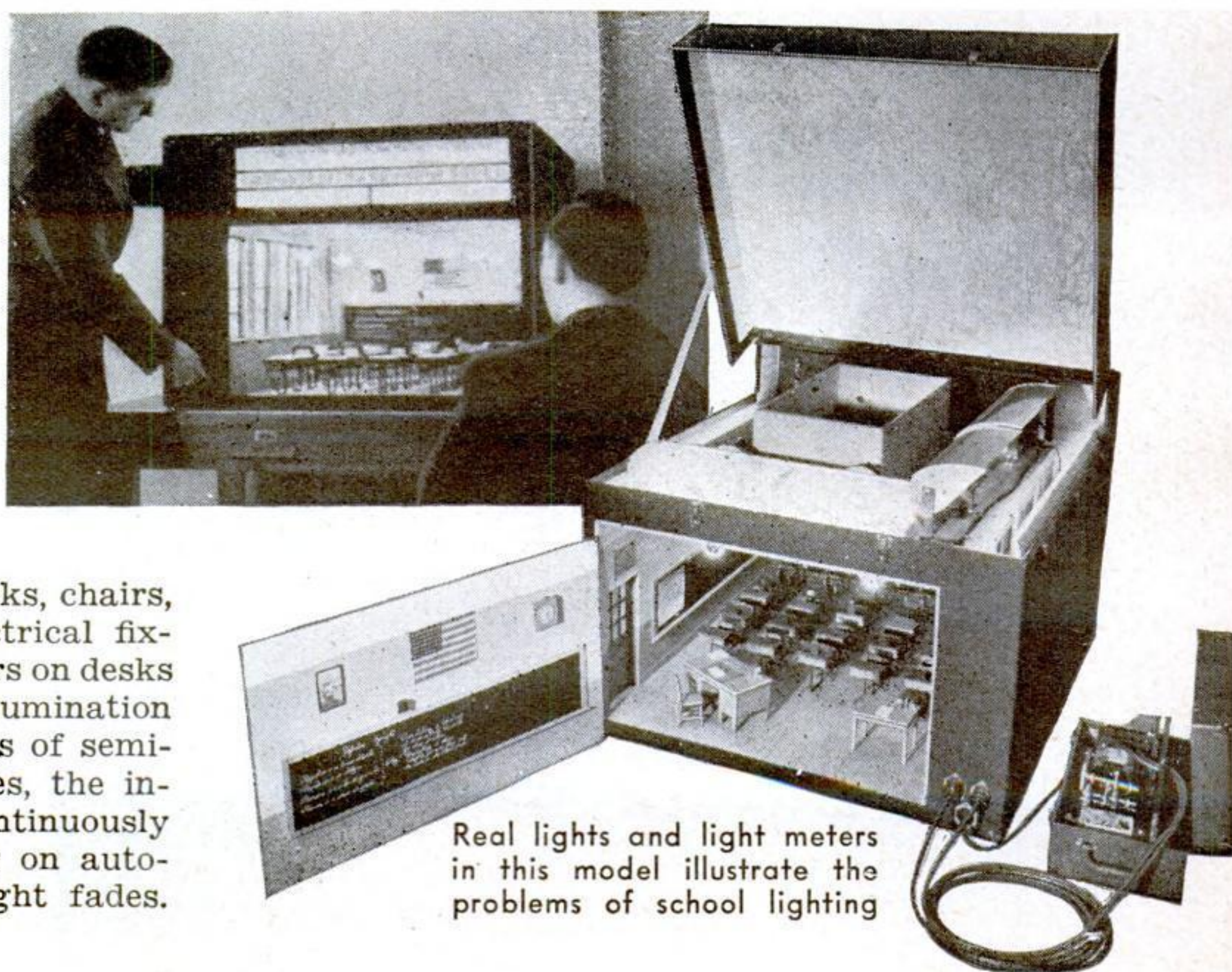
Electric Organ Aids Telegraph

NINETY-SIX telegraph messages can be sent simultaneously in one direction over a single circuit by an ingenious communication system just perfected by Western Union engineers. The system utilizes a tone generator of the type used in an electric organ, where electrical impulses replace conventional pipes and reeds in producing musical notes. Communication engineers, knowing that multiple messages could be sent over a single wire on different tone pitches, experimented with the organ mechanism until they discovered that by selecting pitches 300 cycles apart in frequency, they could place twenty-two of them on a single circuit. Since each of these pitches could simultaneously carry a number of messages by methods previously used, a total of ninety-six communications in each direction is now possible.

Demonstration of new system for sending messages on different tone pitches

Model Schoolrooms Demonstrate Efficient Lighting

SCHOOLROOMS in miniature are now aiding lighting engineers to demonstrate the type and amount of illumination necessary for safe and efficient classroom vision. Thirty-eight inches wide, thirty inches high, and forty-two inches deep, the scale-model classrooms are fully equipped with tiny desks, chairs, blackboards, and electrical fixtures. Five light meters on desks show the amount of illumination coming from two rows of semi-indirect ceiling fixtures, the inner row burning continuously and the outer coming on automatically when daylight fades.



Real lights and light meters in this model illustrate the problems of school lighting

SHOES FROM Butterfly Wings

By
EDWIN TEALE

MORE than 1,000 times, Karl Deubel of Atlantic Highlands, N.J., mixed together chemicals and painted them on butterfly wings. More than 1,000 times, he threw away his mixtures and began again. Month after month, for nearly ten years, Deubel searched for a magic fluid which would enable him to preserve the exotic beauty of insect hues. The results of this Odyssey of research were announced only the other day.

Department stores, in various parts of the country, placed on display novel, eye-catch-

Karl Deubel, with Mrs. Deubel, applying insect wings to heels for women's shoes. Many striking designs are achieved



Dancing slipper and dress ornament owe their brilliant colors to butterflies

ing ornaments coated with the wings of tropical insects. The transparent, enamellike covering, provided by Deubel's secret fluid, made them possible. It brings the beauty of rare butterflies out of the museum into everyday life.

The thing that first strikes you when you meet Deubel is that he is anything but a cartoonist's idea of an entomologist. Tanned and broad-shouldered, he looks more like a construction engineer than an indoor scientist concerned with the study of insects. Yet, most of his life has been devoted to collecting and mounting butterflies and moths.

As a boy, he made trips with his father, a noted collector, in the Black Forest region of Germany. During his college years, he spe-

**A New Jersey Inventor Sets
a New Note in Fashion with
the Discovery of a Process
To Preserve the Iridescent
Beauty of Insect Wings for
Decorating Wearing Apparel**





This girl is fitting together the treated wings and gluing them to a specially made flexible backing

cialized in insect study and afterwards worked in the museum at the University of Freiburg. Later on, he became curator of insects at the private museum of the King of Saxony. Then, in 1926, he came to America to head the entomological section of one of the largest natural-history supply houses in the country.

This extensive background of experience aided him in 1928 when he began tackling a problem which had stumped hundreds of men before him. He set out to find a fluid which would form a hard, transparent and pliable covering for the iridescent wings of tropical butterflies. He knew almost nothing about chemistry when he began. One of his first discoveries was that acetone altered the color of the wing scales. Water could not be used as a base for any of the mixtures, for a butterfly's wing sheds water like a duck's back.

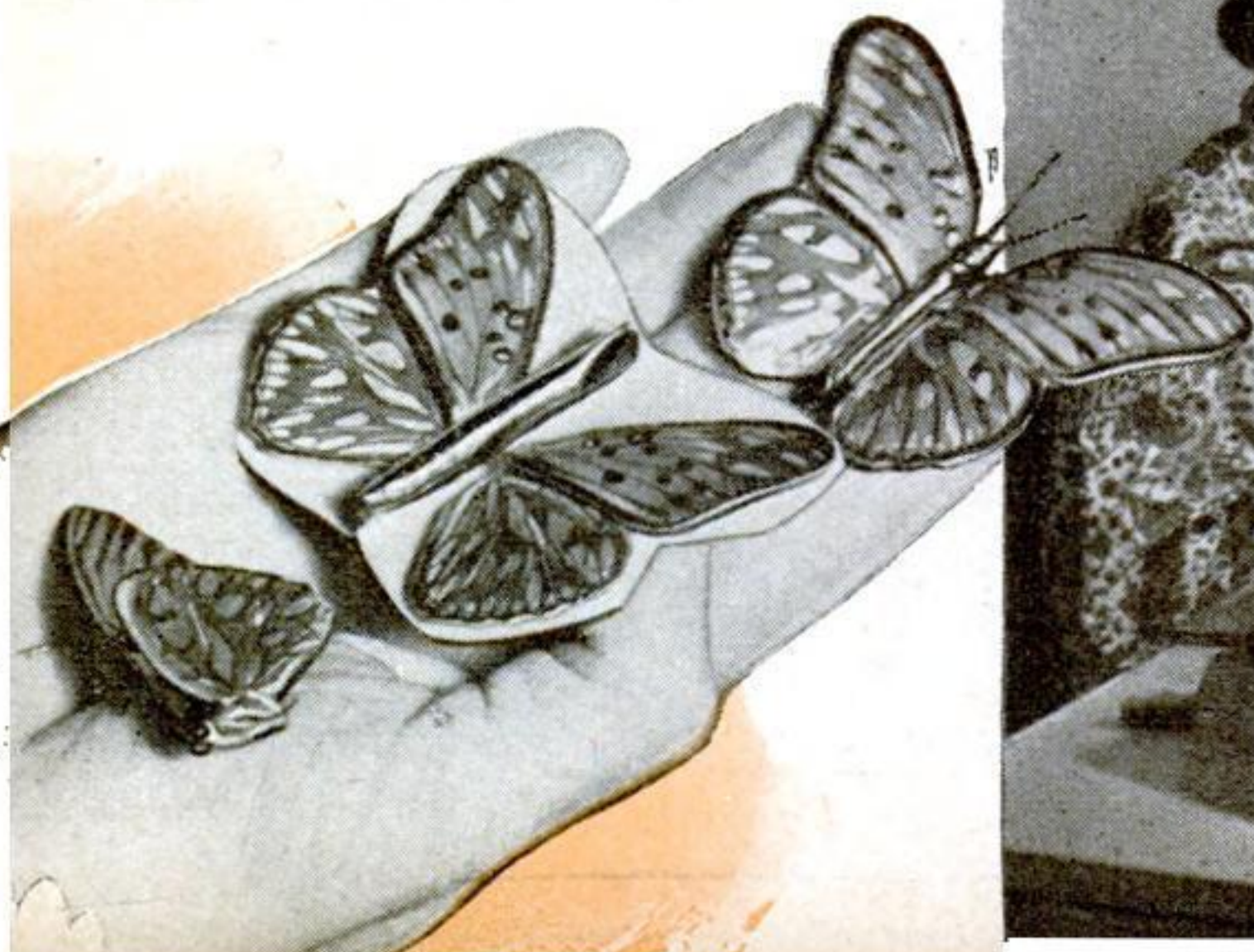
Making his experiments in the kitchen, the basement, the garage, Deubel stuck to his problem, trying out hundreds of different chemicals in an infinite variety of combinations.

At the right is a group of workers in Deubel's shop at Atlantic Highlands, N.J. Below, three of the stages in the making of a dress ornament from a butterfly

The successful mixture is formed of rare gums stirred into fluid ingredients. At the Atlantic Highlands plant, where the new ornaments are being manufactured, this fluid is sprayed on as one of the last steps of production.

On the day I visited the factory, Deubel was busy unwrapping packets of insects coming in from far corners of the world. One wall of a well-lighted room is lined with boxes, each holding a different kind of moth or butterfly. Taking down box after box, Deubel showed me rainbow moths from Madagascar, owl's-head butterflies from Central America, iridescent blues from Brazil, "painted ladies" from California. One packet, which had come in just before I arrived, contained insects from the South Seas. It had traveled part of the way on the China Clipper flying boat. Other consignments, he told me, were on their way from the Dutch East Indies. They were traveling to Amsterdam, Holland, by plane and across the Atlantic by boat.

The insects which travel by train, boat, and airplane to reach the Atlantic Highlands plant form the raw material out of which the ornaments are produced. From the wings, decorated with patterns and shadings unlike anything else on earth, Deubel is turning out strikingly beautiful shoe buckles, dancing slippers, and hair and coat adornments. In manufacturing his rainbow-hued products, he employs more than 1,000 different kinds of insects. *(Continued on page 248)*





Color Photo by Edwin Teale

BACKS OF BUTTERFLY DRESS ORNAMENTS BEING COATED WITH MOTHER-OF-PEARL ENAMEL

How the New POPULAR



Special binding allows the new-size magazine to lie flat opened

WITH this issue, POPULAR SCIENCE MONTHLY appears in a new and improved form—more compact, more colorful, and, oddly enough, both smaller and larger. With more than twice the number of pages contained in average issues of the past, with more than five times as many of them printed in color, and with convenient book-type binding which permits opening the magazine flat upon a table or desk, POPULAR SCIENCE gives to its readers the greatest value they have received in the sixty-six years of its existence.

Only by the construction of the fastest two-color magazine press in the world—a quarter-of-a-million-pound giant that cost nearly a dollar a pound—was this major advance made possible. Experts at the Goss Printing Press Company, in Chicago, Ill., labored for more than half a year designing and building the immense machine. It contains upwards of fifty innovations found in no other printing press in the world. Approximately one fifth of a block long and more than one story high, forty-eight feet in length and sixteen in height, it is the biggest as well as the fastest two-color magazine press ever to go into operation.

At the huge Dayton, Ohio, plant where POPULAR SCIENCE is printed, a workman, the other day, pressed an electric button and this record-breaking machine whirled into action. At full speed, it printed the magazine you hold in your hand in less than half a second. While the average person is pronouncing the name, POPULAR SCIENCE MONTHLY, the racing press will print three booklike copies of this publication.

One of the most spectacular features of the

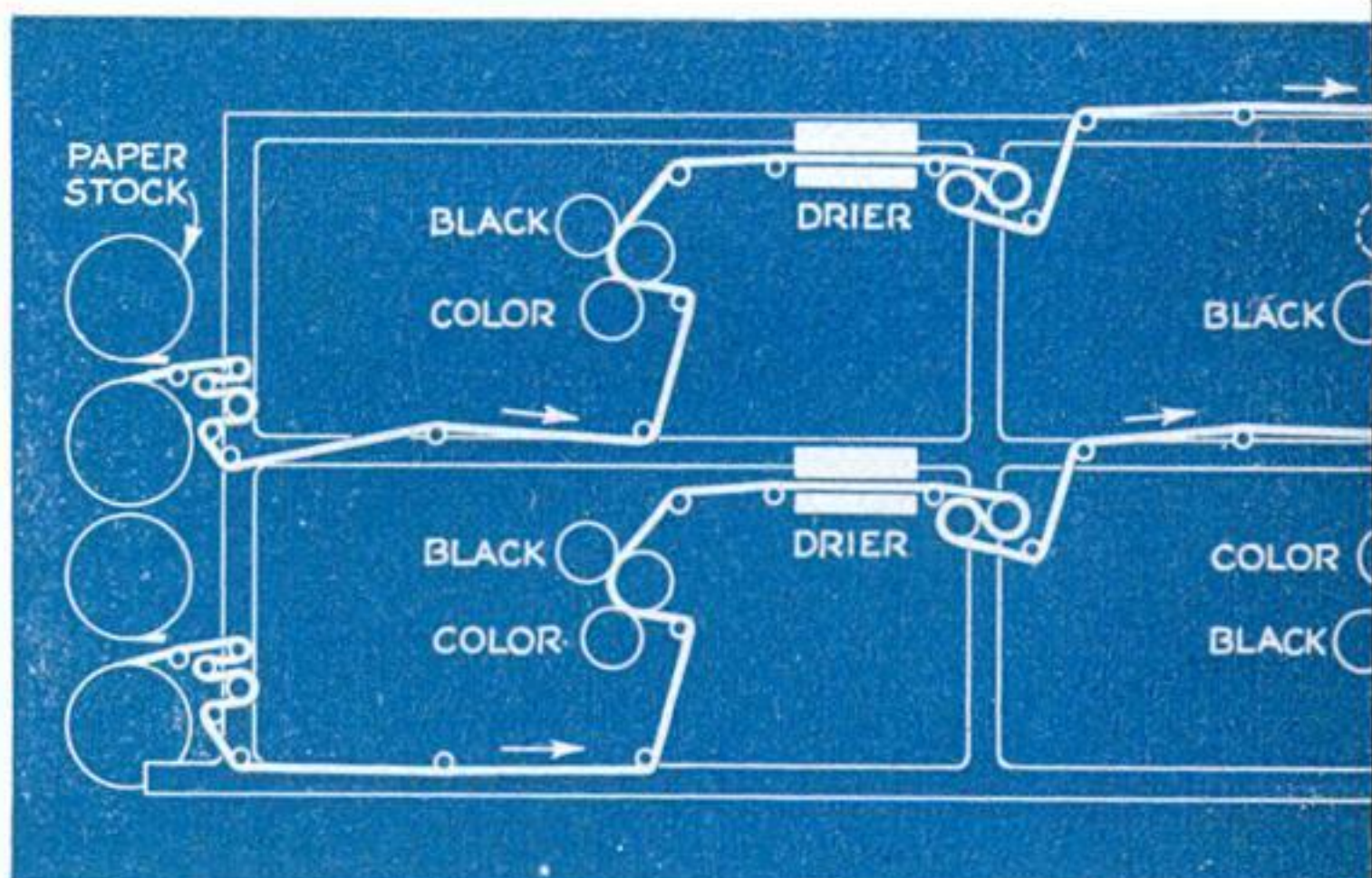
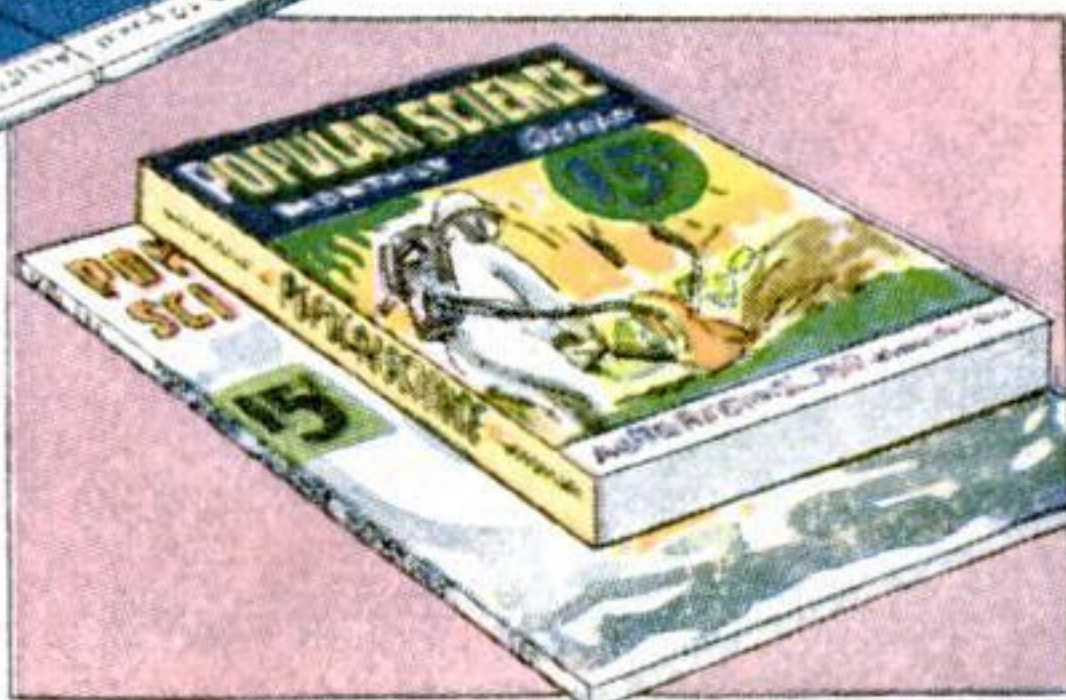
press in action is "blotting the ink with flame." Gas-fed fire that reaches a temperature of 2,200 degrees F.—sufficient to turn steel white-hot—plays over the paper. Yet, as though by some magic, the paper is not even scorched. Its temperature never rises above 180 degrees. The explanation lies in the fact that the streaming sheets are rushing by so fast they have no time to ignite, just as you can flick your finger through a candle flame without being burned.

But, while the paper is not ignited, inflammable oils in the ink are burned, leaving the printed page completely dry. As the wide ribbon of paper passes over the drying apparatus, moving approximately sixteen feet a second, a faint, running flame, like St. Elmo's fire, races along the ink of the printed lines. Using fire to blot the pages is one of the most important of the innovations which have been combined to make the record-shatter-

ing speed of the new press possible.

To appreciate this speed, consider a few graphic comparisons. If the pages that pour from the racing press in the course of a *single hour* were stacked up in front of you and you began counting them at the rate of one page a second, nearly a month would go by and the next issue of the magazine would be on the press before you finished! More than 2,000,000 pages are printed in the giant machine in sixty minutes—enough, if placed lengthwise, to form a ribbon of printed and colored paper reaching from New York City to Norfolk, Va.

Approximately 200 feet of paper, nearly five feet wide, is running through the press at one time. It is fed in at one end from two great



Courses followed by ribbons of paper on their 100-foot journey

SCIENCE Is Printed

World's fastest two-color magazine press, built at a cost of nearly \$250,000, prints the new POPULAR SCIENCE

CYLINDRICAL PRINTING PLATE TRANSFERS INK TO PAPER

STRIP OR "WEB" OF PAPER PASSING THROUGH PRESS

WATER-COOLED ROLLER COOLS PAPER LEAVING OVEN

REFOLDING MACHINE SERVES UP HALVES OF PRESS

OVEN DRIES INK

UPPER AND LOWER HALVES OF PRESS

CATWALK

FINISHED PAGES, FOLDED AND ARRANGED IN PROPER ORDER, COME OUT OF MACHINE READY FOR BINDER



gh the press

POPULAR SCIENCE, OCTOBER 1938

Copyrighted material

the paper. Locked on each cylinder are twenty-four plates, representing forty-eight pages of the magazine. After passing over the first plate cylinders, the sheets are reversed so the other sides are printed in passing over the next cylinders. At the end of the press, the sheets are cut into strips as wide as a page of the magazine is long. In the folding mechanism, these strips are cut and stacked into signatures, or series of consecutive pages. The final step in manufacture is accomplished by another machine. It places the signatures in order and binds them between covers to produce the magazine as you see it.

By discarding the common methods of binding—wire-stitching or stapling—the new POPULAR SCIENCE provides increased convenience for the reader. Special elastic glue, which does not lose its pliancy when dry, holds the pages together and permits the magazine to lie open like a well-made book.

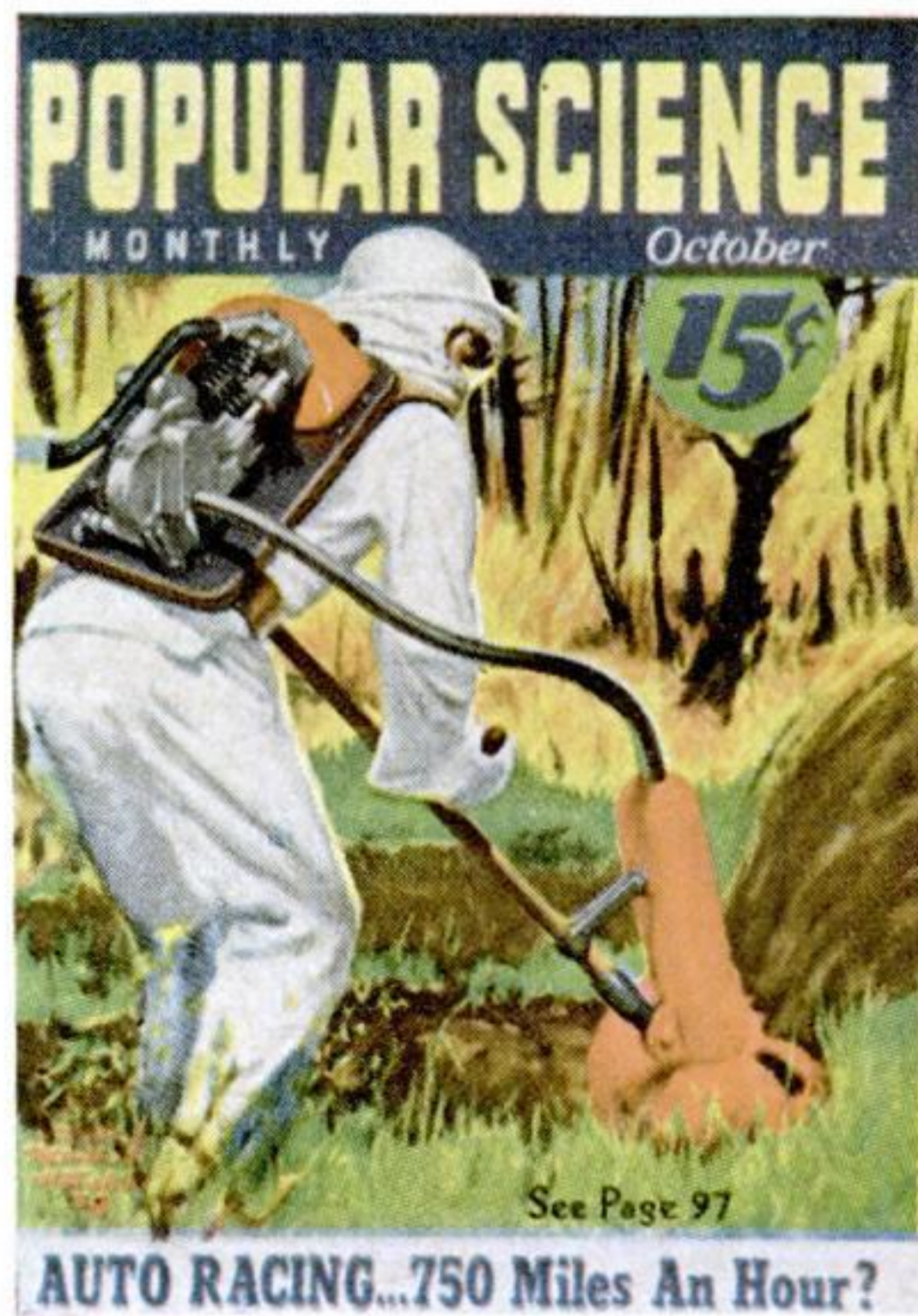
The 500-percent increase in the number of color pages, adding so much to the attractiveness of the magazine, required the installation of special features in the new press. Grooved cylinders, lined like graph paper, aid in the delicate work of getting the color plates in register, that is, in exactly the same position on the page. At the delivery end of the press, a battery of knobbed rods permits the shifting of the paper to right or left at any point during a run. In addition, special tension rollers keep the paper ribbon flowing smoothly between the plate cylinders without jerking or seesawing.

These great cylinders, each weighing more than two automobiles, are constructed

of extra-hard steel to prevent distortion when they are whirling at their top speed of 12,500 revolutions an hour. One turn of the press produces 192 printed pages. The details of operation of the great machine are shown in the drawing prepared by our staff artist. A smaller diagram traces the paths followed by the two ribbons of paper on their 100-foot journey through the press.

Despite its huge size, the press is built almost like a fine watch, and it is able to produce in two revolutions more reading matter than you will find in an average book. In a split second, it turns out a magazine which requires weeks of concentrated effort to prepare and which would take you more than a day of solid reading to complete. Through its high-speed efficiency, it is possible to give you a bigger and better POPULAR SCIENCE without an advance in price.

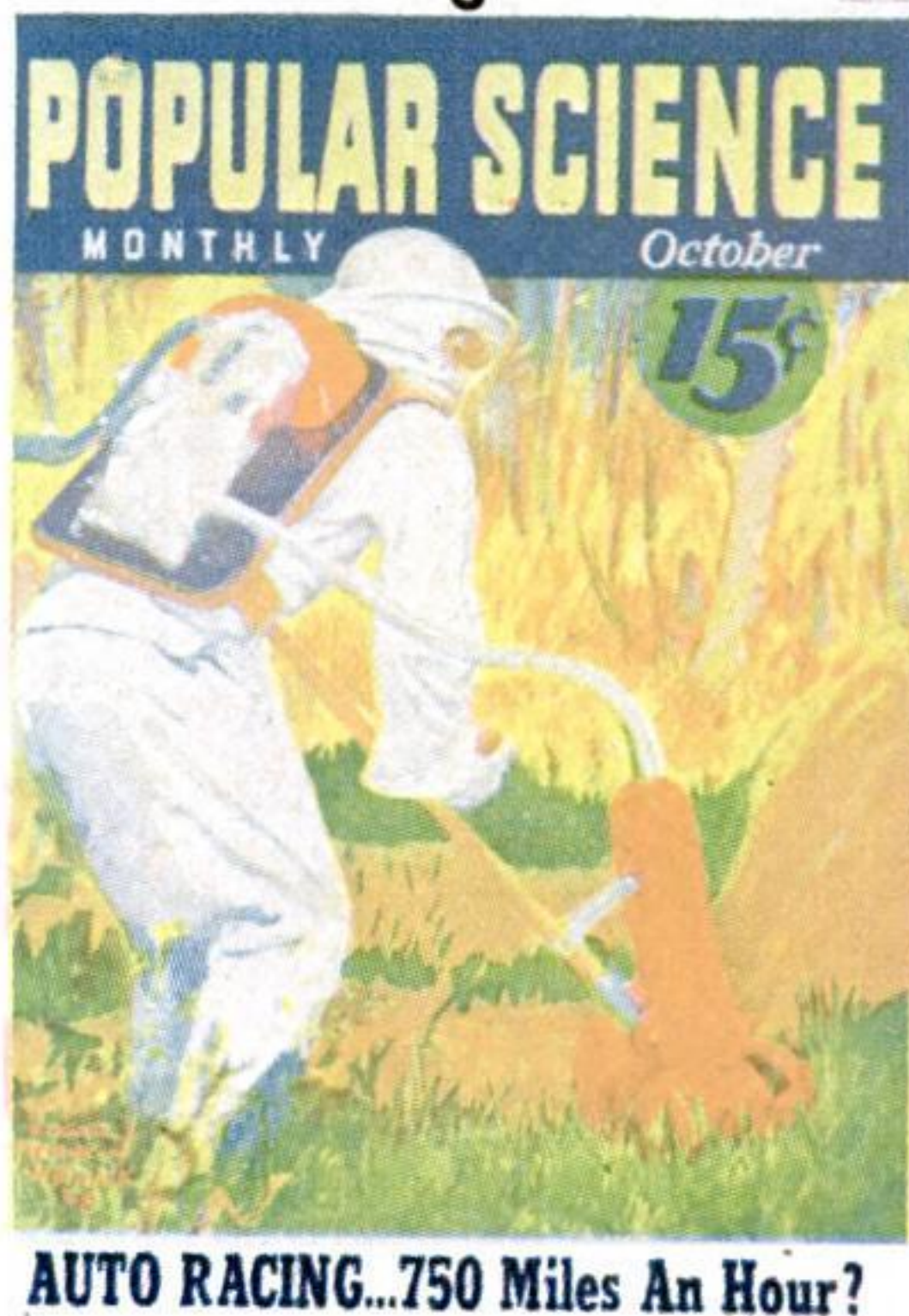
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HOW COLORS ARE BLENDED TO PRODUCE OUR COVERS

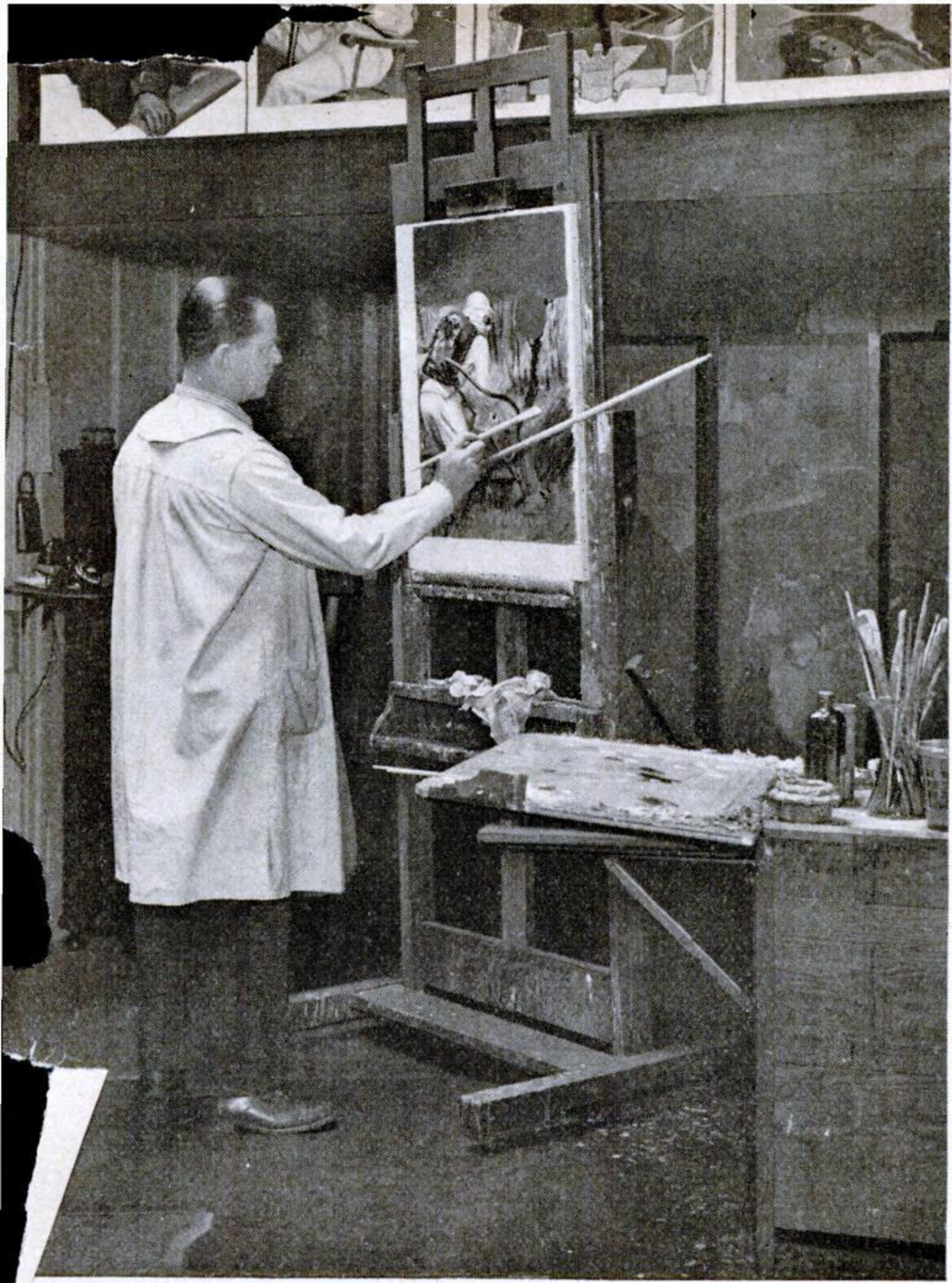
2

3



- 1 Impression of the yellow printing plate in which all areas of original painting containing yellow appear
- 2 Combined impression of yellow and red areas, made by printing successively with the yellow and red plates
- 3 Bluish areas are filled in by next printing with the plate on which all but blue images have been eliminated
- 4 A fourth and final plate provides the black which accents the colors and strengthens the shadows

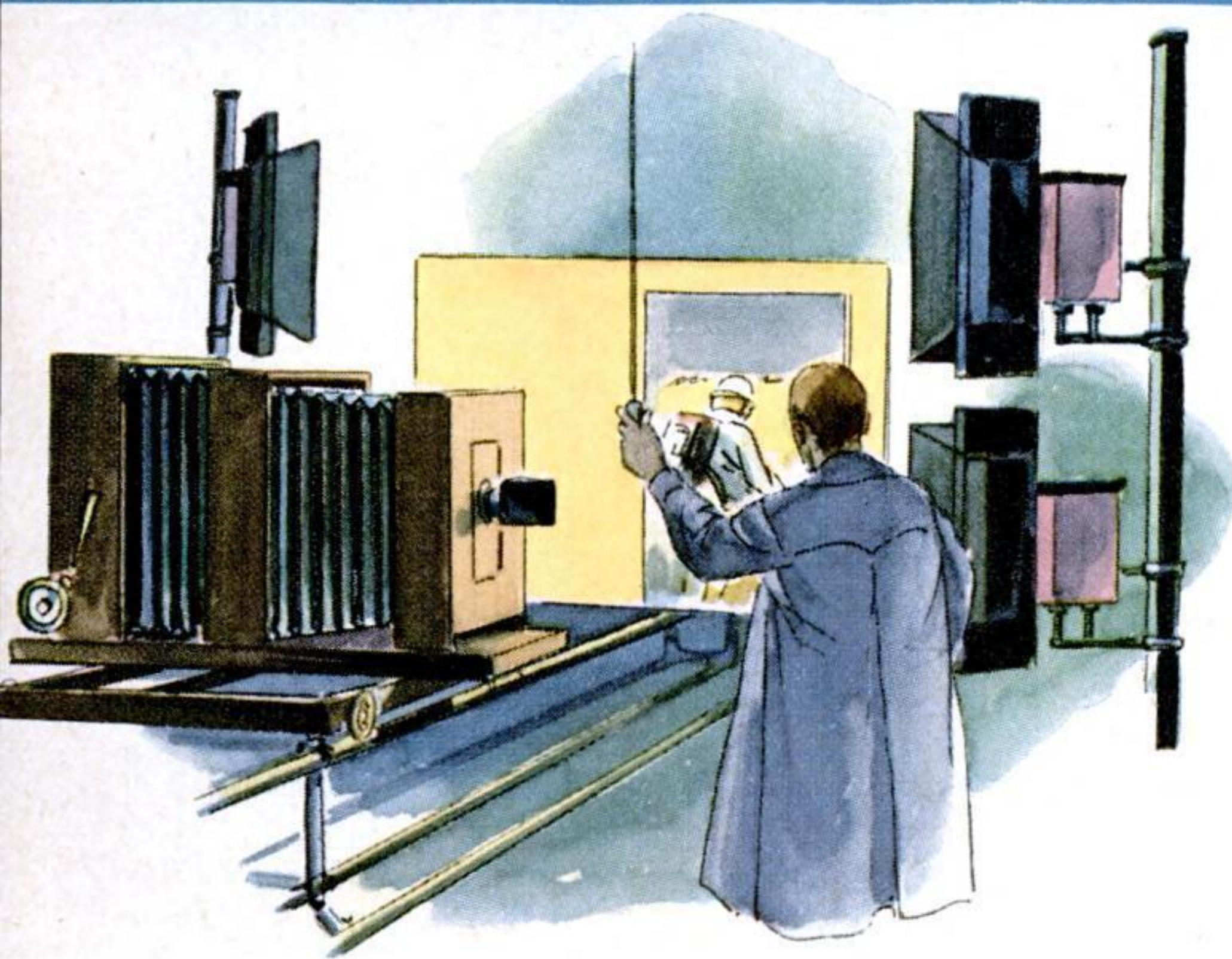
POPULAR SCIENCE



rolls that weigh a ton apiece. On its journey of a fifth of a block to the other end of the press, it is stamped with words, covered with color, split by circular knives into narrower ribbons, run over turning bars, cut, and folded into the exact size of the magazine.

A curious feature of the turning bars, which carry the sheets downward into the folder after their run through the main press, is the fact that the paper rides over them on a layer of air. Tiny holes perforate the polished rods. Out of these holes, compressed air is forced at the exact pressure necessary to hold the paper a fraction of an inch above the metal and eliminate all possibility of smudging the printed pages. Instead of turning on rollers, the paper turns on a rolling layer of air.

While the upper unit of the press is printing one part of the magazine, the lower unit is printing another. Like cloth going through a clothes wringer, the paper strips pass between rollers and the cylinders which hold the inked electrotypes that transfer the printing and illustrations to

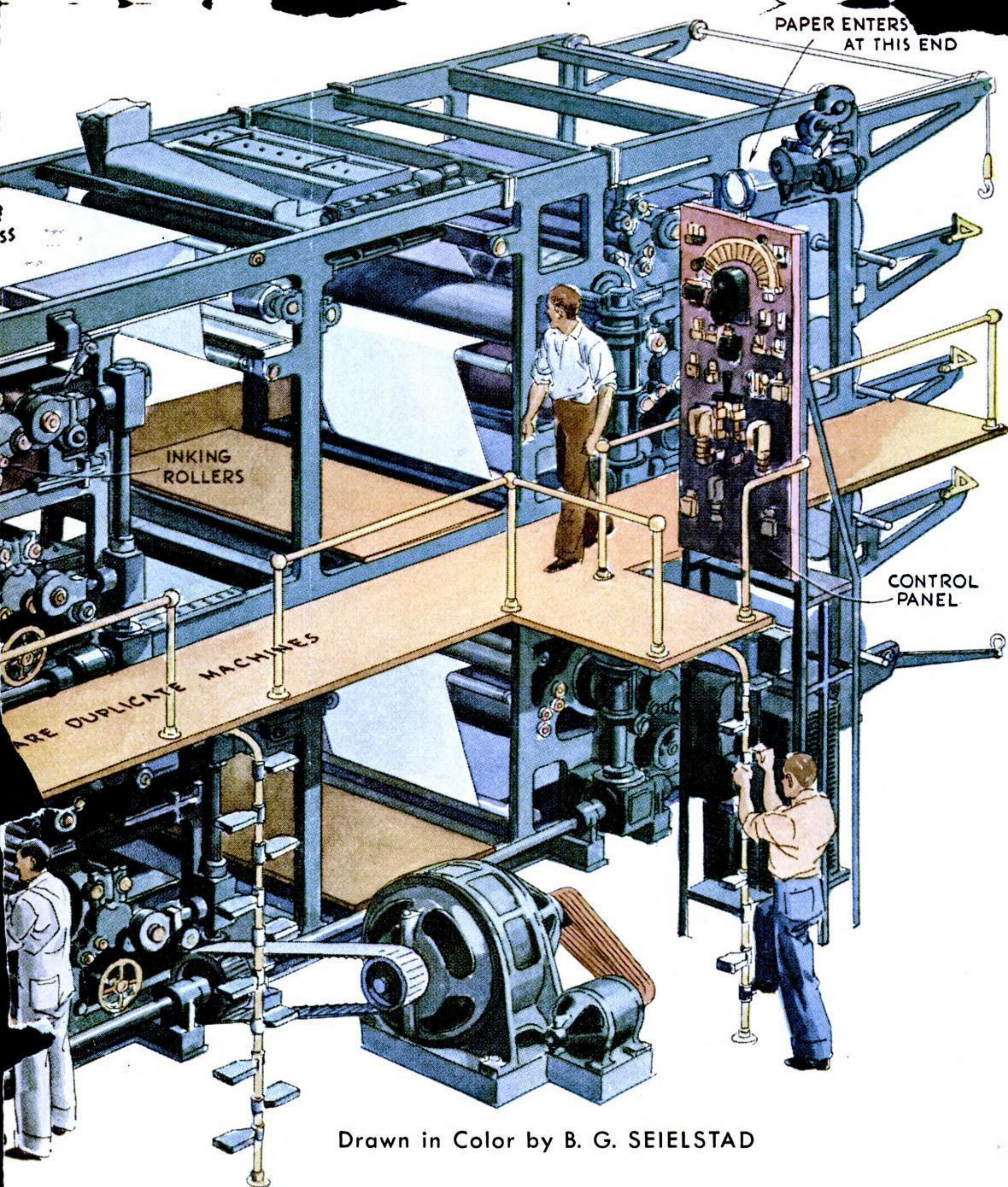


"PROGRESSIVE PROOFS" SHOW

1



MAKING THE COVER PAINTING. In the photograph at the top of the page, our cover artist, Edgar Franklin Wittmack, is seen completing the original oil painting for the cover of this issue of the magazine. The drawing above shows how the painting is photographed through color filters in the course of the color-separation process which produces the color plates from which the cover is printed



Drawn in Color by B. G. SEIELSTAD

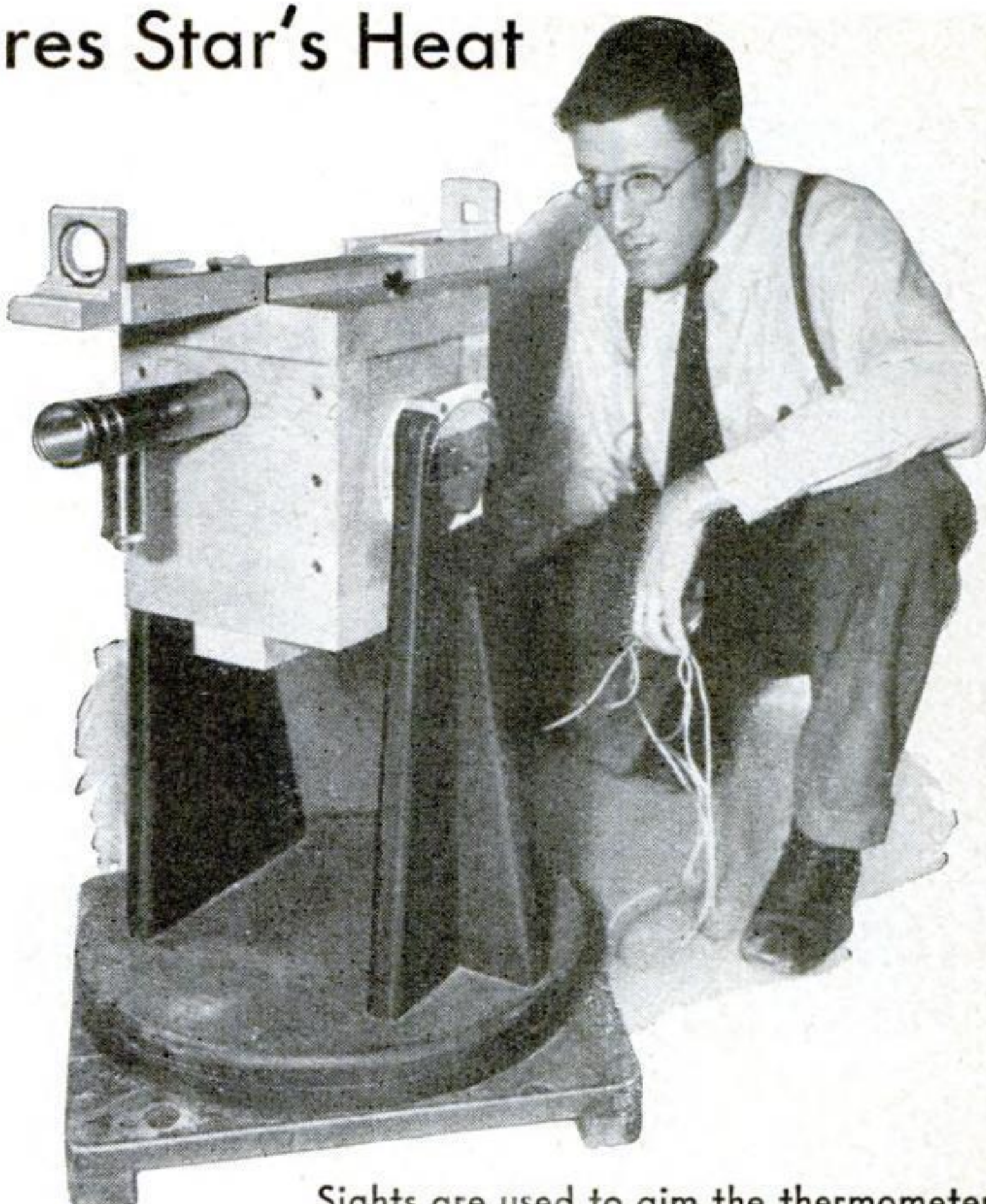
Step Behind the Scenes in the Great Printing Plant Where This Magazine Is Produced, and See the Modern Miracles of Mechanics That Enable Us To Offer You a Bigger, More Convenient, More Beautiful Magazine than Ever Before—and Without an Increase in Price!

Gun Thermometer Measures Star's Heat

AIMED like a gun, an ingenious astronomical thermometer designed by Dr. John Strong, astrophysicist at the California Institute of Technology, Pasadena, Calif., takes the temperature of any heavenly body at which it is pointed. Utilizing in its construction such items as gold specks, rock-salt lenses, quartz crystals, and hair-thin wires, the delicate instrument is expected to provide valuable scientific data for the use of meteorologists as well as astronomers. It is pivoted on a revolving base.

New Oil for Rubber

HARMLESS to rubber, a new lubricant announced by Du Pont engineers is derived from a nonpetroleum base. Intended especially for places in automobile bodies where rubber and metal come in contact, the substance will not damage the rubber, as is frequently the case with regular machine oil.



Sights are used to aim the thermometer

Transparent Mask Keeps Shampoo Suds from Eyes

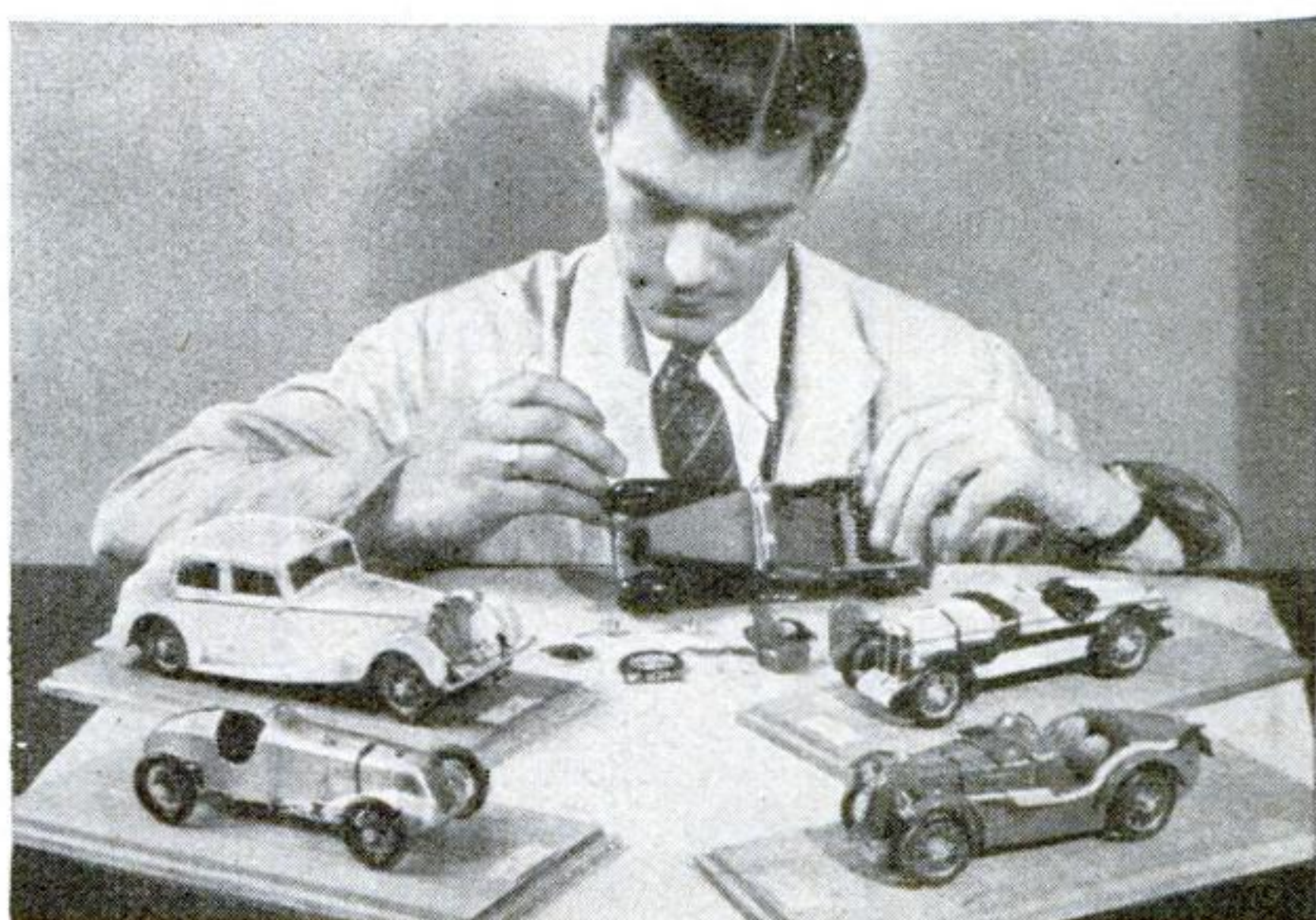
SOAPY water, oil, or special scalp preparations cannot run down into the eyes of persons shampooing their hair when they wear a novel face guard just placed on the market. Made of a transparent, waterproof material, the guard fits snugly against the forehead and hangs down over the face, as indicated in the illustration at the left. Elastic strips that loop around the ears of the wearer hold the transparent guard in place. Breathing is not interfered with by the mask, which is open at the bottom.



Shampooing in comfort with the protective face mask

Model Shop Produces Midget Automobiles

COMPLETE from bumper details to tail lights, model automobiles built to the exact scale of their prototypes are being manufactured in a London, England, workshop. The cars are fashioned according to photographs and accurate detail drawings of the originals, some being sold to the public as novelties while others are made especially for automotive manufacturers. An English sportsman, who has been building the miniature models as a spare-time hobby, sponsors the business enterprise.



Several examples of the work turned out by the model makers

He Works With Strands of Spider Silk



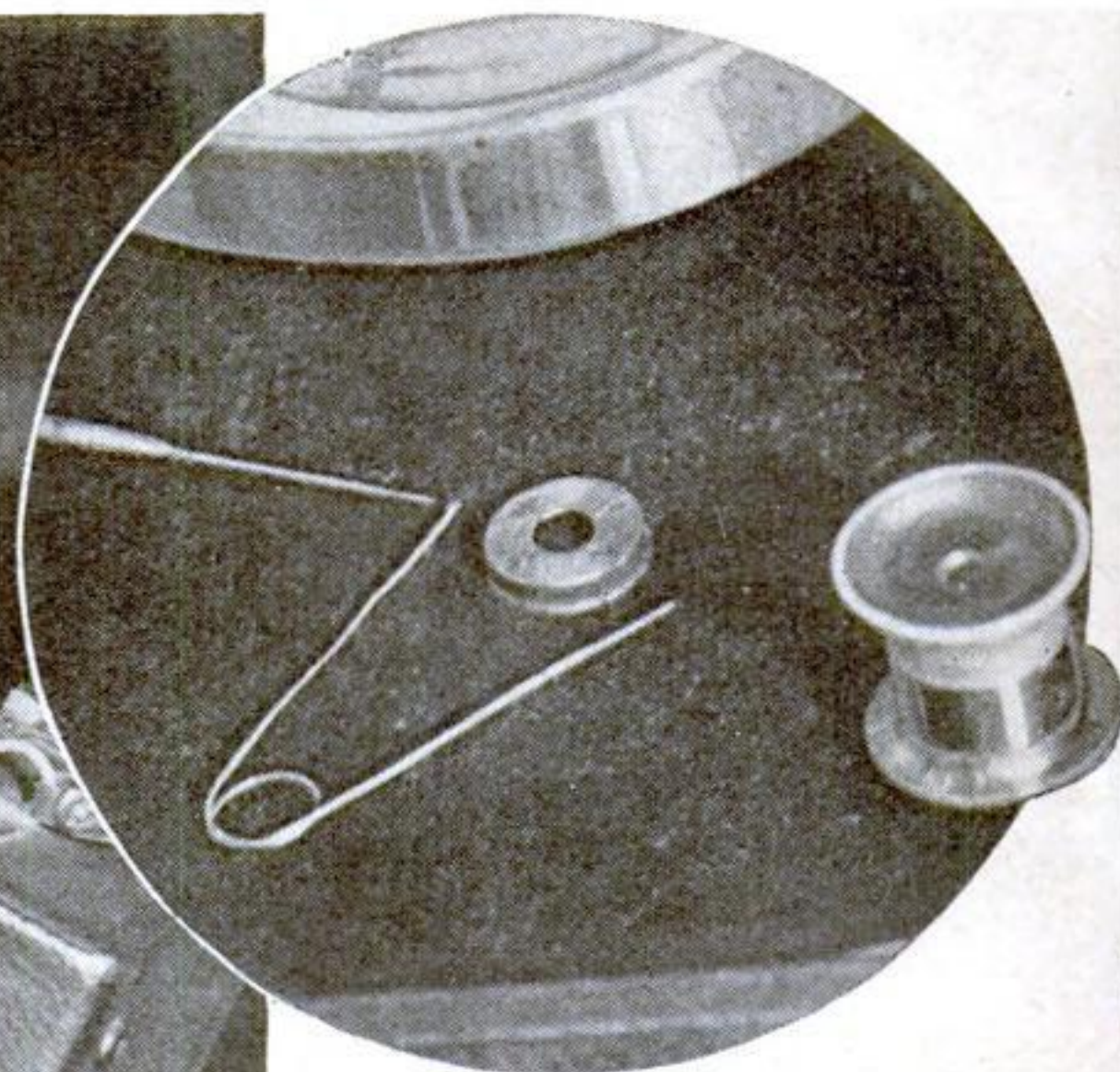
Dr. John G. Albright preparing a length of spider-web silk for a lens

SPLITTING hairs would be coarse work for Dr. John G. Albright, of the physics department of the Case School of Applied Science, at Cleveland, Ohio. His unusual occupation is splitting threads of spider silk and mounting them in optical instruments to produce cross lines and grids. Such crossed and parallel lines in the eyepieces of microscopes, surveyors' transits, astronomical telescopes, and telescopic gun sights enable the observer to center the image and to measure movement and distance.

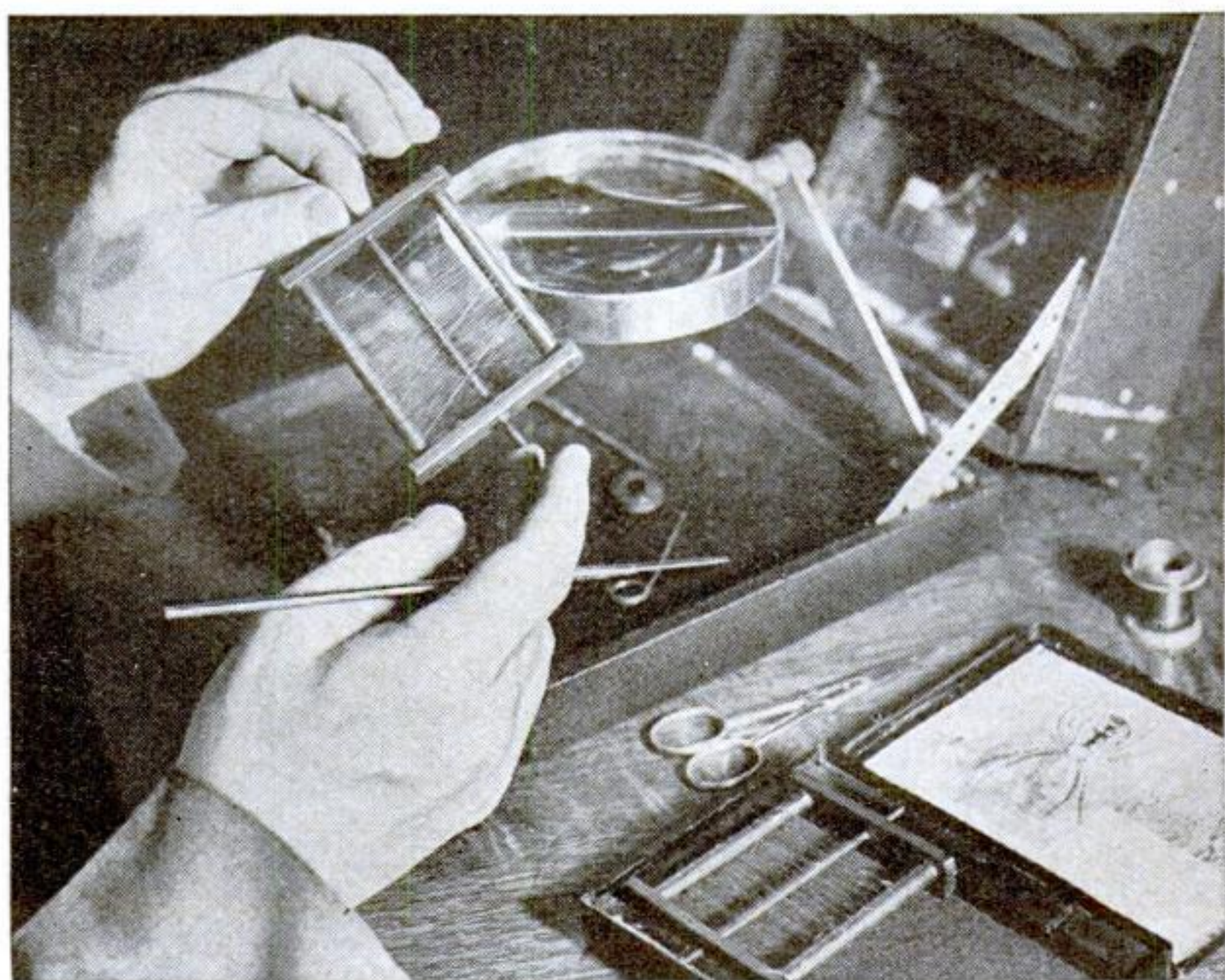
In obtaining the silk he uses, Dr. Albright finds a female of the large black-and-orange garden spider. While an assistant holds her with a forked stick, he attaches the end of the silken thread from her spinnerets to a small reel he carries. Then he starts winding and the spider obligingly spins her silken cable as he reels it in. From one female, he obtained as much as 250 feet of silk.

Back in his laboratory, he sets to work with magnifying glass, dissect-

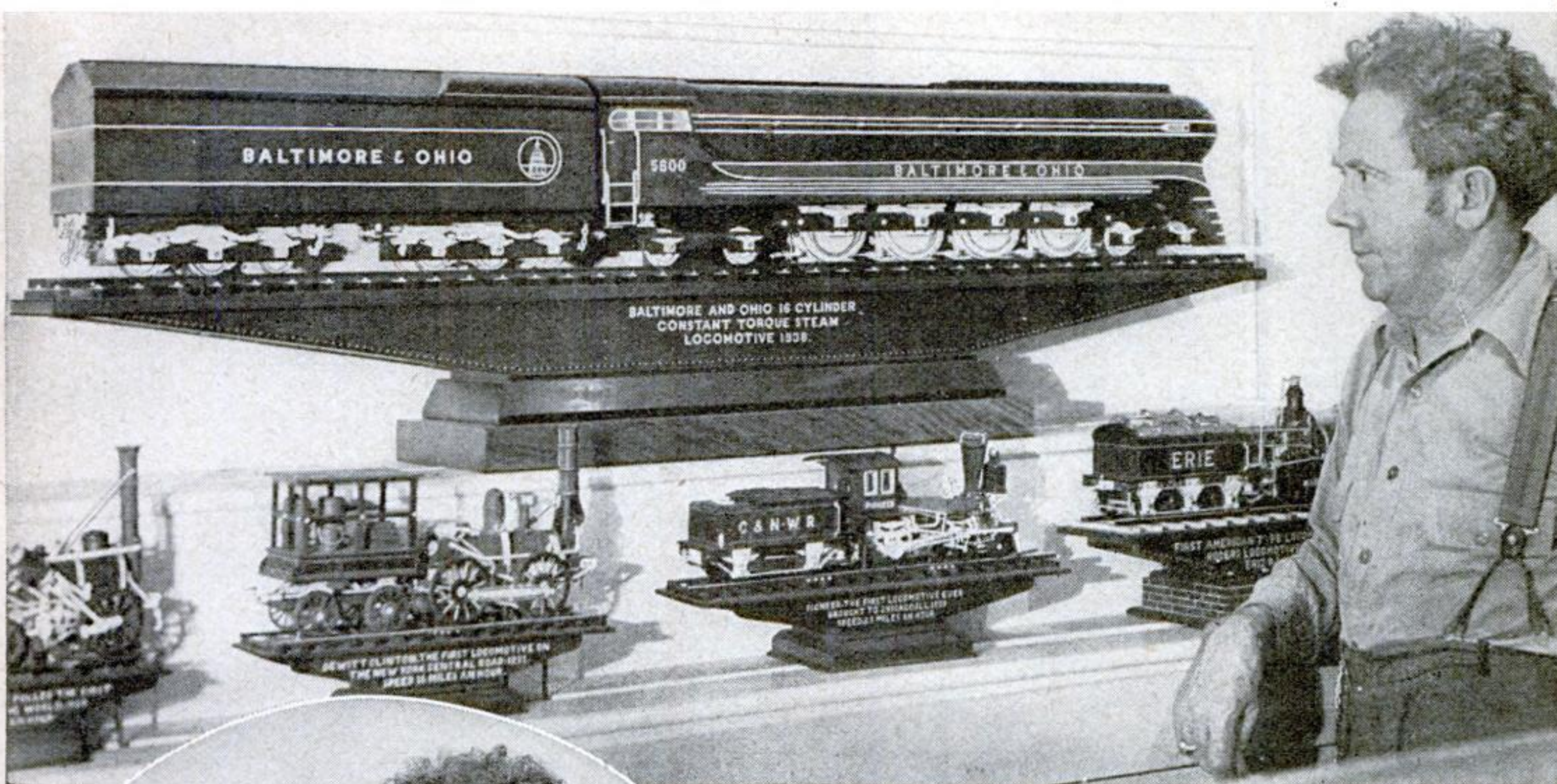
ing needles, tweezers, bent pieces of wire, and a tube of quick-drying cement. His first job is to separate the silk thread into its individual strands. To do this, he cements an inch or so of the thread to the tips of a springy, forked wire that holds the silk taut. With a dissecting needle, he separates the strands and mounts them on the supports which fit into the eyepieces of optical instruments.



Incredibly thin strands of spider web are first glued between the ends of the bent wire, above, then split apart with needles under a glass



When the spider silk is collected it is wound on a small reel

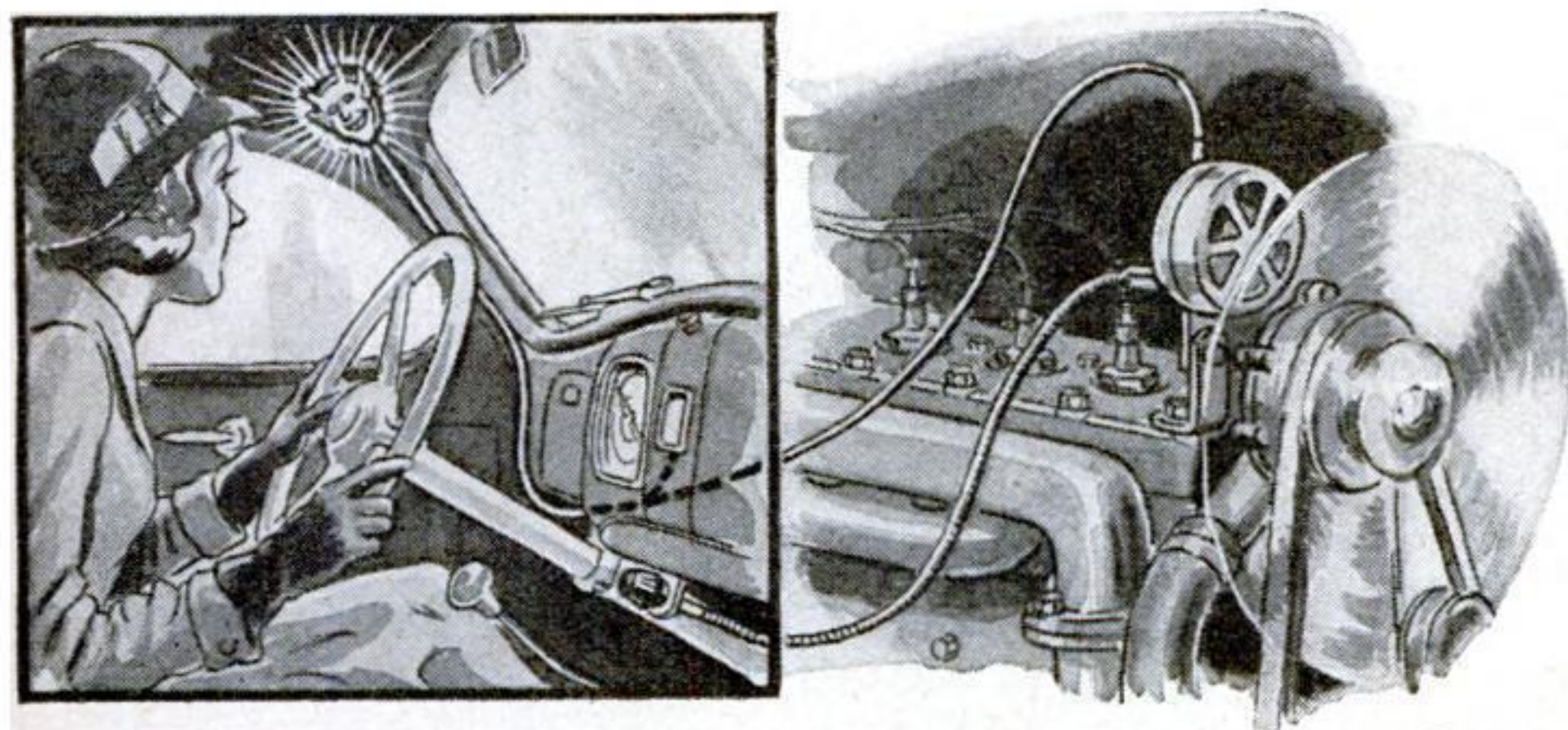


Ernest Warther beside locomotives in his museum. The treelike object is 511 pairs of pliers carved from a single wood block such as he is holding

Amazing Whittled Models Carved With A Penknife

SCALE-MODEL locomotives carved by hand from ebony, ivory, black walnut, bone, pearl, and other rare materials are the outstanding features of an amazing home museum in Dover, Ohio, which displays the work of its owner, Ernest Warther, who has gained world-wide fame as a master carver. Doing practically all his work solely with a knife, Warther finishes his locomotives in minute detail, even to such items as the correct curve in the ivory bell rope of each engine. Electric motors turn the carved wheels and drive shafts, and because a special wood, which contains natural oils, was used for the bearings, they have never had to be lubricated. Another astounding museum item is a group of 511 pliers carved from one block of wood.

Safety Light In Car Warns Speeding Motorist



A knob on the dash fixes the speed at which the bulb is to light

CLIPPED to the upholstery near the driver and shaped like a devil's head, the light bulb of a new automobile safety device flashes on to warn a motorist when he reaches a dangerous speed. The accessory is actuated by a device mounted back of the engine fan. The force of the air from the fan, which increases with car speed, blows a hinged metal disk back until it makes an electrical contact that lights the warning bulb.

SECRETS OF A Fire Diver

...

PLUNGING eighty feet through space in a death-defying back somersault into flaming gasoline, Jimmy Jamison, circus and carnival dare-devil, has thrilled spectators more than 3,000 times. How he performs the risky night stunt is shown by our artist on this page.

Climbing to a height of nearly seven stories above the ground, Jamison takes his stand on a tiny platform at the top of a narrow spruce ladder braced with steel cables. An assistant, below, tosses a pailful of gasoline on the water in a tank, six feet deep and fifteen feet in diameter. The carnival-ground lights go out. The assistant ignites the gasoline. With a crackling roar, flames leap a dozen feet into the air. Jamison, facing the ladder and with only his toes on the edge of the platform, lines himself up with the center of the tank by sighting between his feet. With his body rigid and his hands on his hips, he jerks his head to the rear and plunges backward into space.

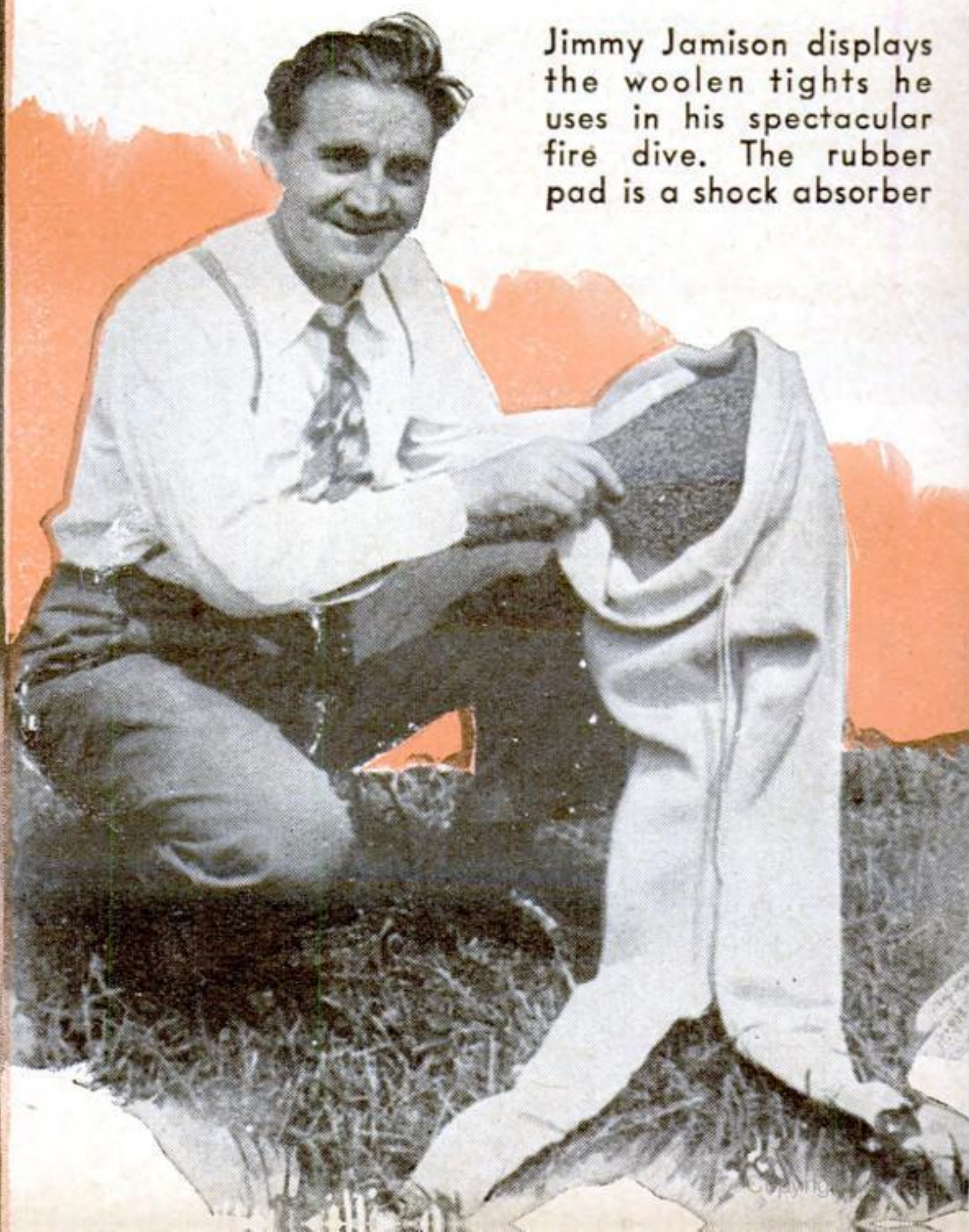
Jimmy Jamison displays the woolen tights he uses in his spectacular fire dive. The rubber pad is a shock absorber

HEAD IS SNAPPED BACK
AT START OF DIVE

BODY IS HELD RIGID
WHILE HEAD ACTS AS
PENDULUM WEIGHT

BACK SOMERSAULT
ENDS WITH BODY
UPRIGHT

SPLASH
EXTINGUISHES
FLAMES

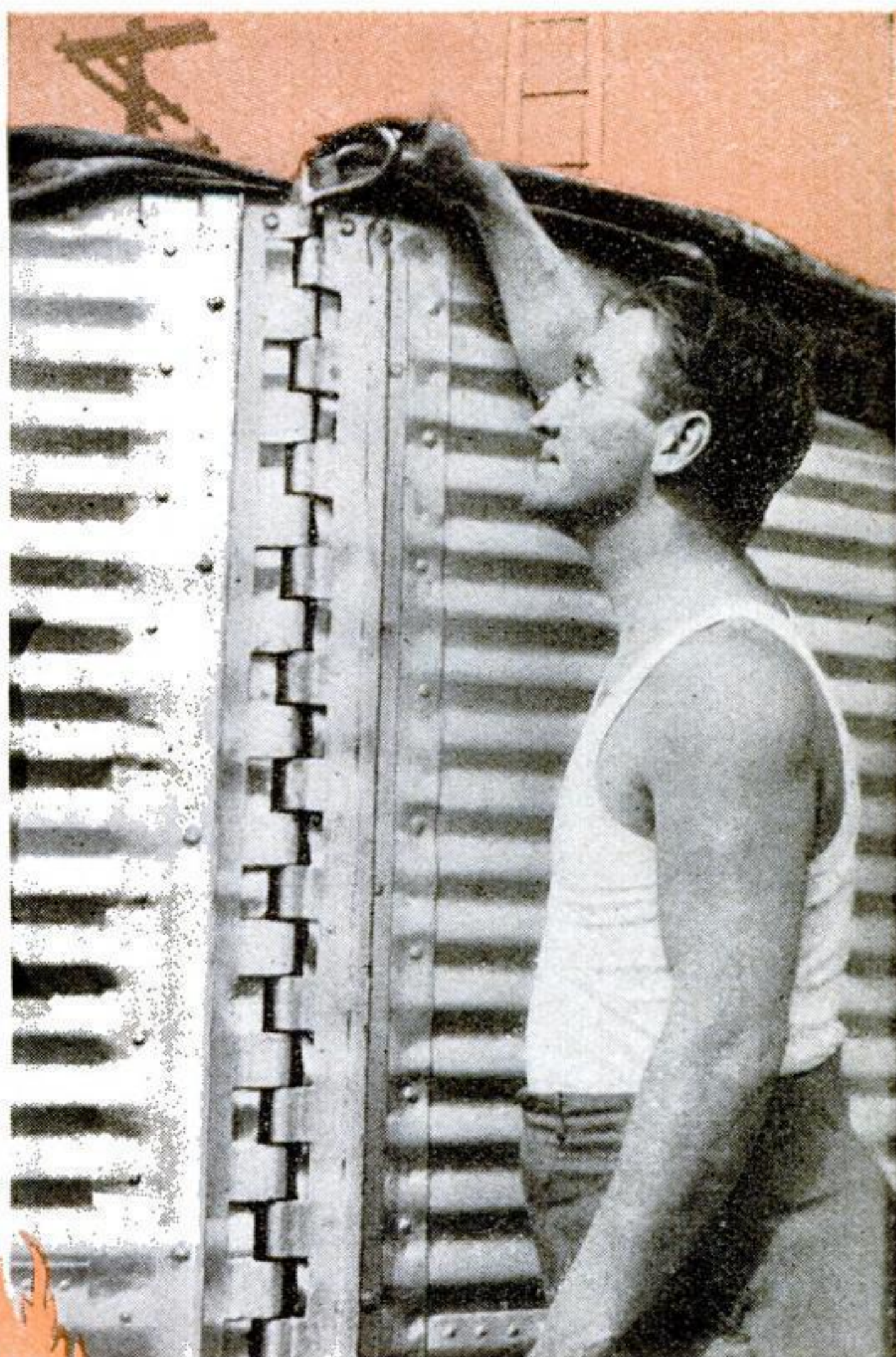


It takes him about a second and a half to come down. His head, acting like a pendulum weight, turns his body in a complete somersault so that he strikes the water feet-first. The splash extinguishes the flames. By raising his legs as they enter the water, Jamison shoots himself away from the bottom, striking the padded side of the tank with his feet.

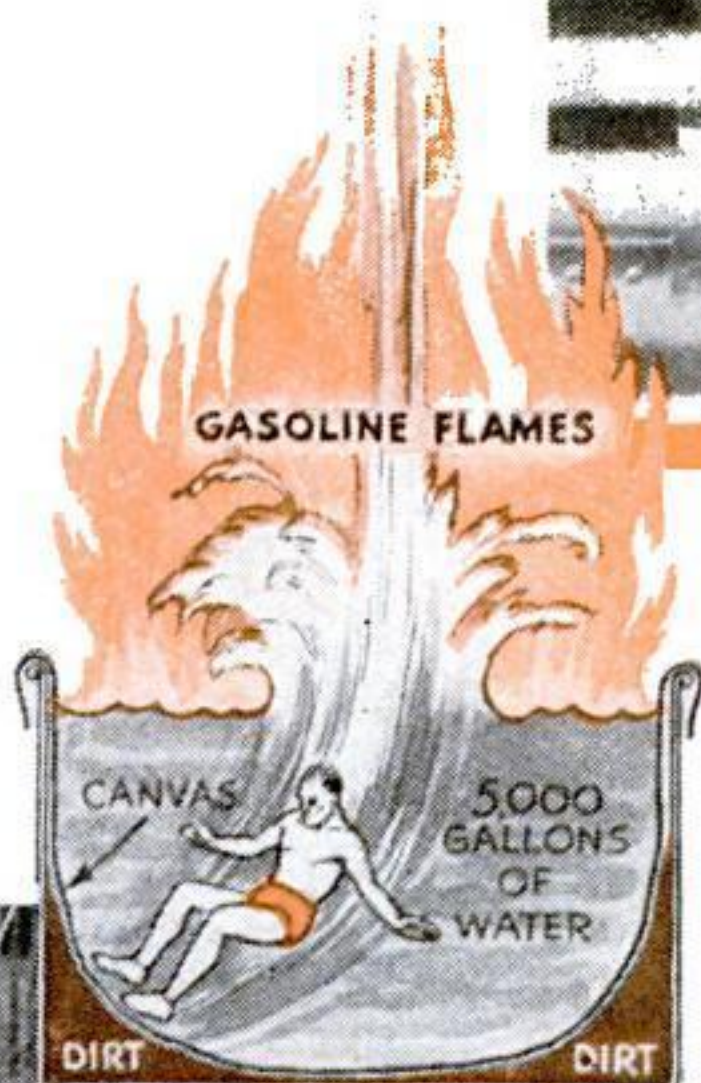
Made in sections to facilitate transportation, the steel tank holds approximately thirty tons of water. A heavy bag of greased canvas lines the interior. Dirt is banked between it and the tank around the bottom to ease the strain on the 5,000-gallon reservoir. During its travels, the great tank has been filled with a wide variety of waters—salt water on Cape Cod, alkali water in the West, black Everglades water in Florida. Once, in the Kentucky mountains, where the natives had never seen a high-diver before, it was filled from a brook by relays of mountaineers working hand pumps all day long.

For sixteen weeks, in 1934, Jamison jumped three times a day from a height of 120 feet at A Century of Progress Exposition, in Chicago. All told, he has traveled more than 150,000 miles during the past sixteen years giving exhibitions. He estimates that he has fallen more than sixty miles through the air in his thousands of dives.

By
ROBT. E. MARTIN



The 5,000-gallon tank comes apart for shipment, and is lined with a canvas bag. Drawing at left shows how the diver hits the tank and takes the shock with his feet



Jamison watching his assistant measure out the pailful of gasoline that provides the flames. At left, he is checking up on the guy ropes that hold the steel cables supporting the ladder tower. For stakes he uses old automobile axles like the ones illustrated

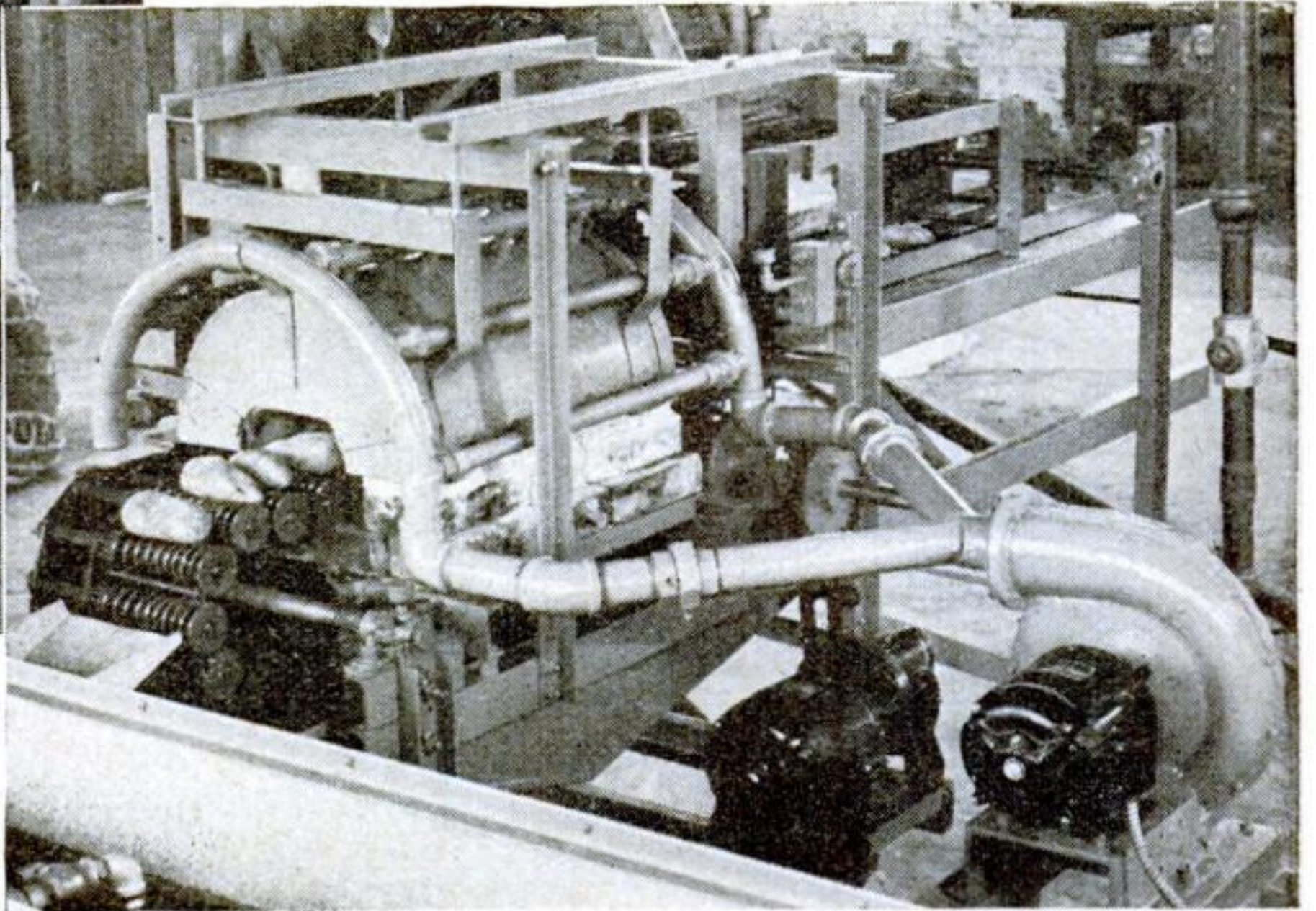




Machine-peeled potatoes ready for packing. Right, spuds entering the furnace where flames blister skins

Gas Flames Peel Potatoes —a Ton an Hour

FLAMES from forty gas burners literally blister the skins off potatoes, in a machine that supplies ready-pared spuds for restaurants, hotels, and homes. After passing through the furnace shown below, potatoes are subjected to the action of water sprays and rollers which take off the loosened skins. The tubers reach the packing table at the rate of a ton an hour.

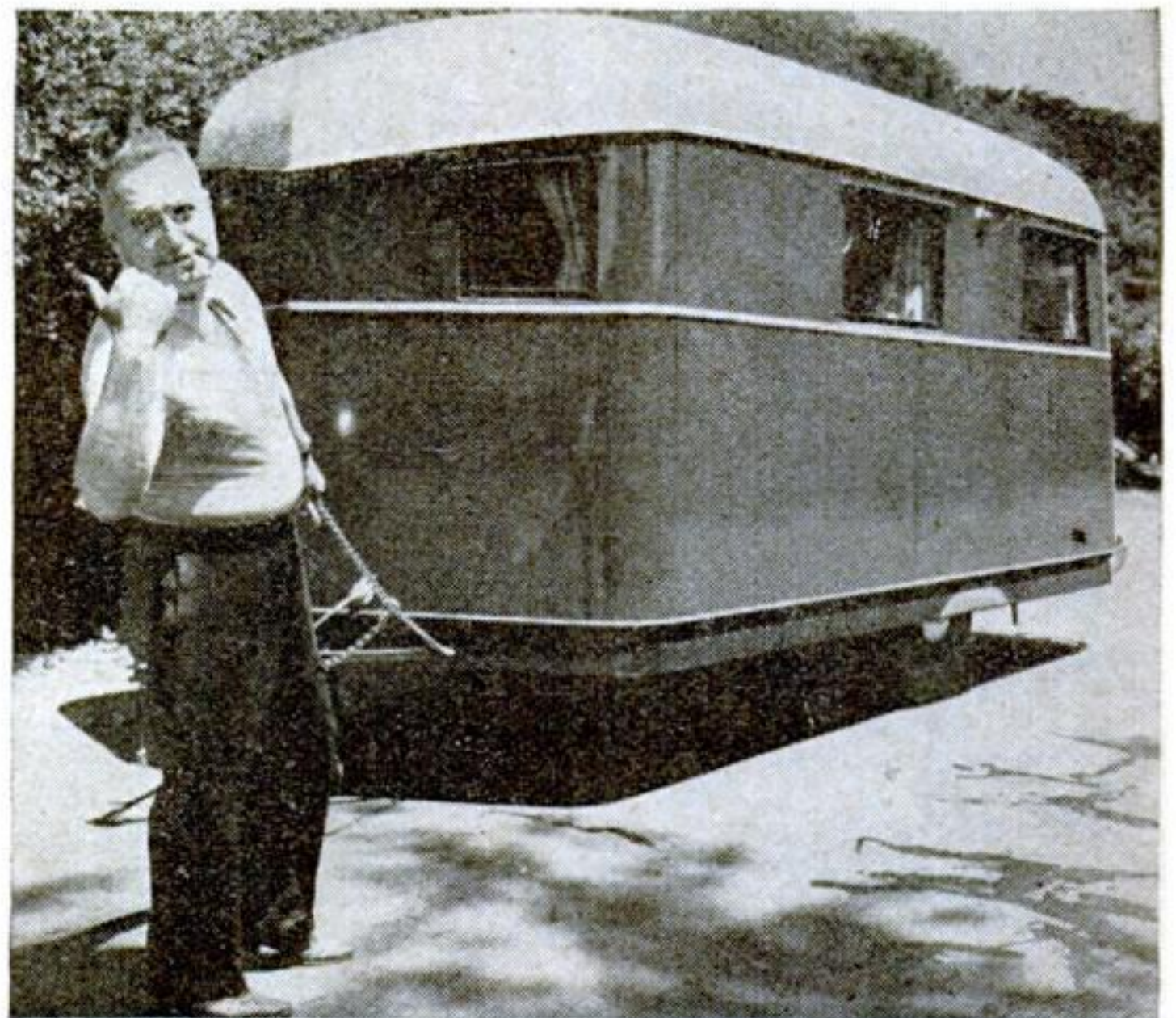


Desk Has Own Blackboard

A BUILT-IN blackboard is a novel feature in a new desk designed especially for children. Hinged to the top, the blackboard is adjustable to five different positions for convenience in writing or drawing. Containing a map of the world in full color on its reverse side, the board rests flat on the desk when not in use.

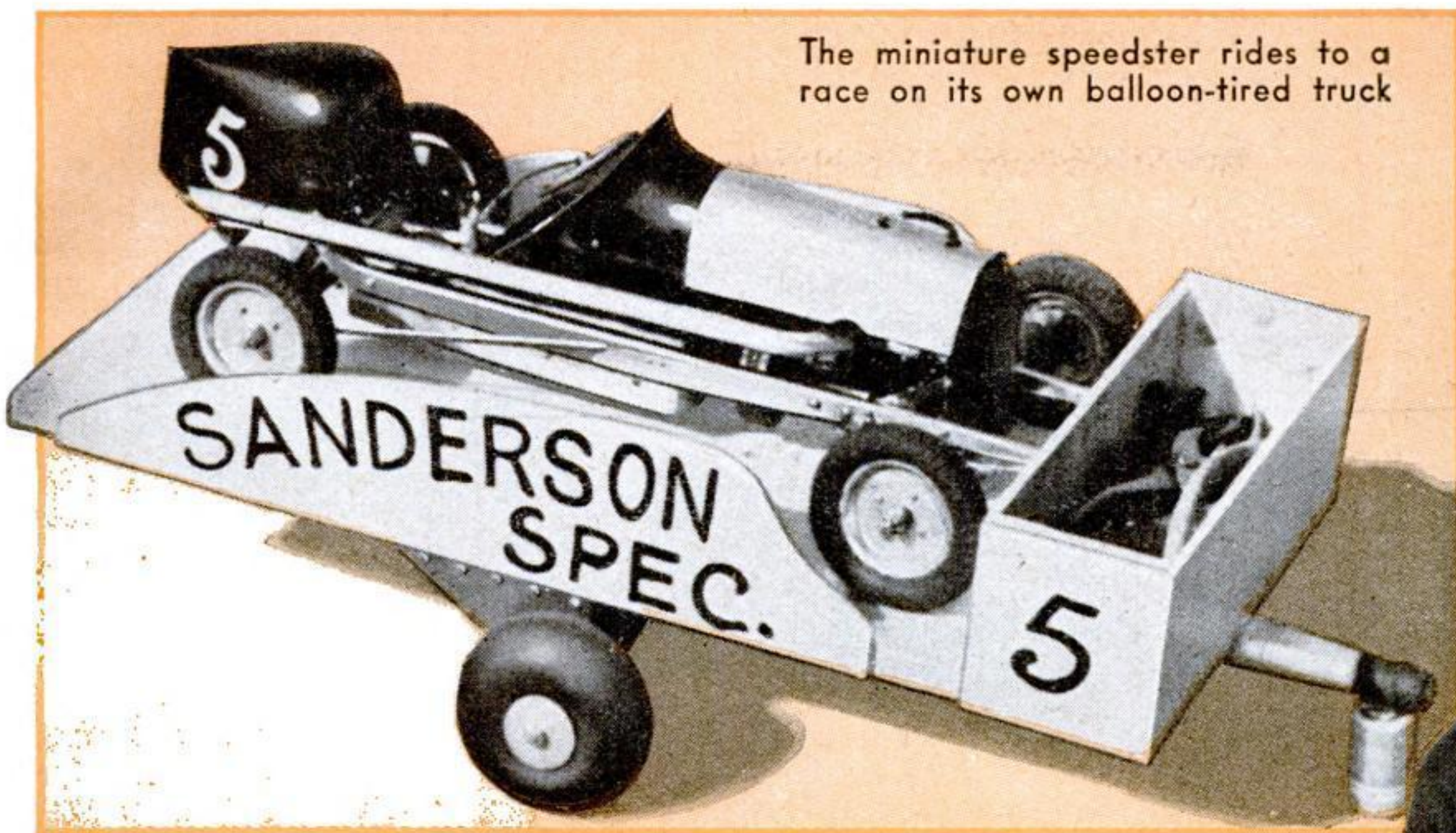
Hitch-Hiker Uses Trailer

THUMBING not only rides for himself but also tows for his trailer is the novel form of hitch-hiking being tried by L. A. Schaldenbrand of Detroit, Mich. To the motorist who is willing to tow his trailer, Schaldenbrand offers free bed and board in his completely equipped home on wheels, which has sleeping accommodations for two.



L. A. Schaldenbrand thumbing a tow for his trailer

The miniature speedster rides to a race on its own balloon-tired truck

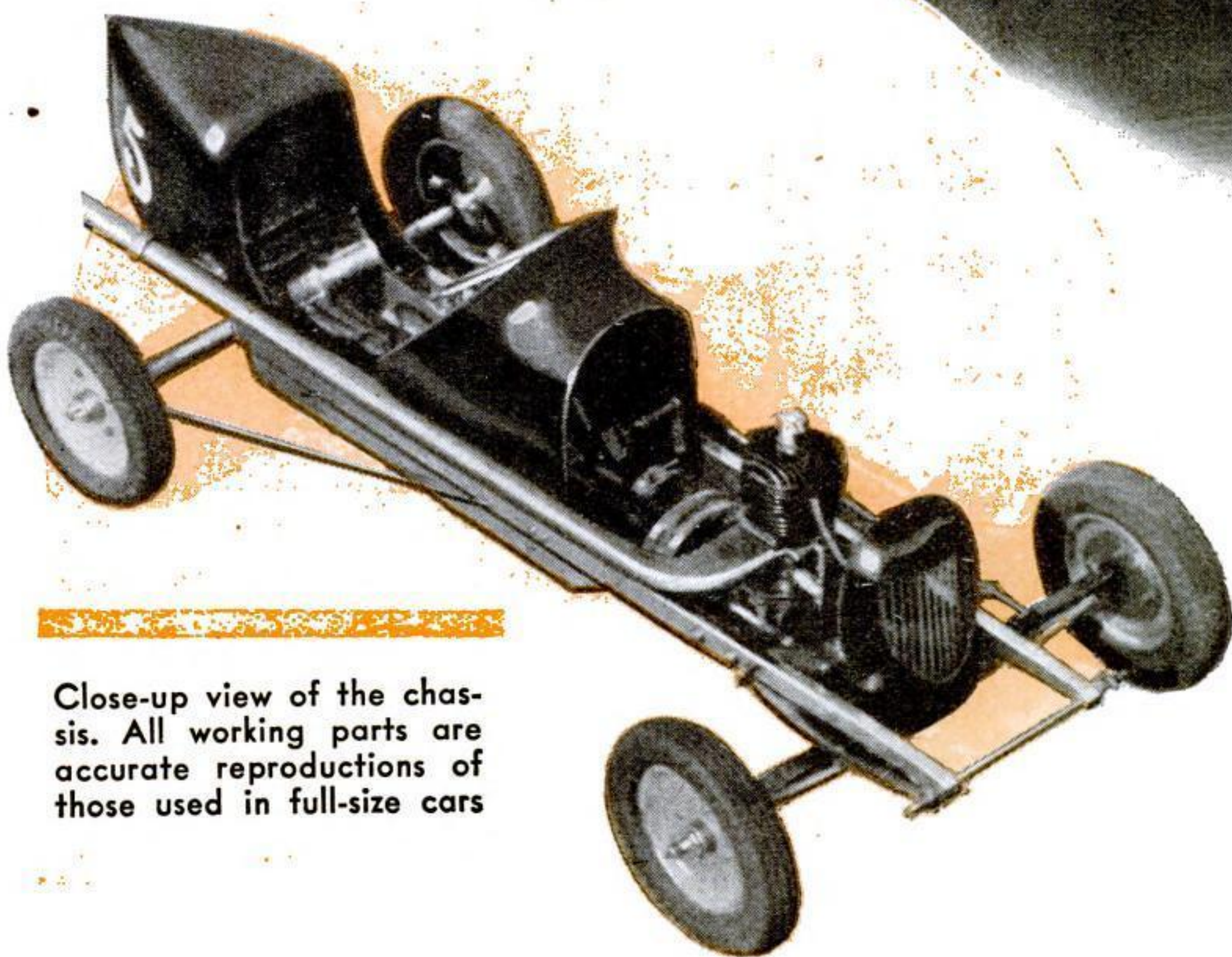


Tiny Homemade Racing Car Has 50-Mile Speed

SPEEDS up to fifty miles an hour are obtained by a remarkable scale-model racing car designed and built by M. G. Sanderson of Santa Monica, Calif. Requiring three months to construct, at a cost of almost \$100, the diminutive racer is perfect in every detail.

The five-pound speedster has a fourteen-inch wheelbase, pneumatic tires two inches in diameter, a differential fitted with a pinion-and-ring gear, roller bearings in all wheels, and six-leaf springs complete with shackles. Powered by a tiny gasoline motor that has a maximum speed of 10,000 revolutions a minute, the midget automobile is matched in races against other cars of similar size, each miniature speedster being held on a circular course by means of a length of cord so arranged that it can pass or be passed by other racers as they whirl around the track.

M. G. Sanderson, of Santa Monica, Calif., with his midget car. It weighs five pounds



Close-up view of the chassis. All working parts are accurate reproductions of those used in full-size cars

Toy Press Has Rotary Type Cylinder

Operated by hand, the toy press will print menu cards, announcements, letterheads, and other similar jobs

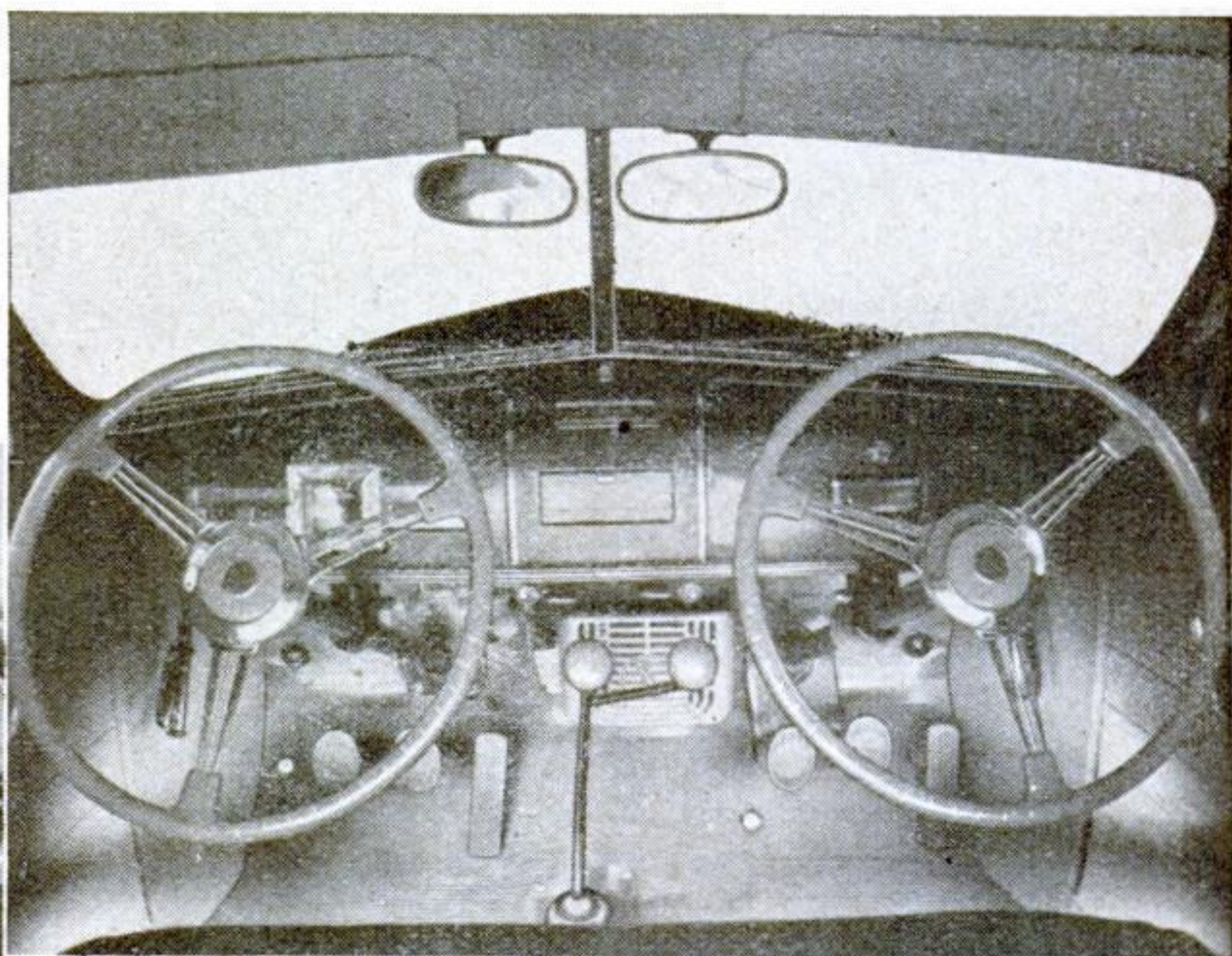
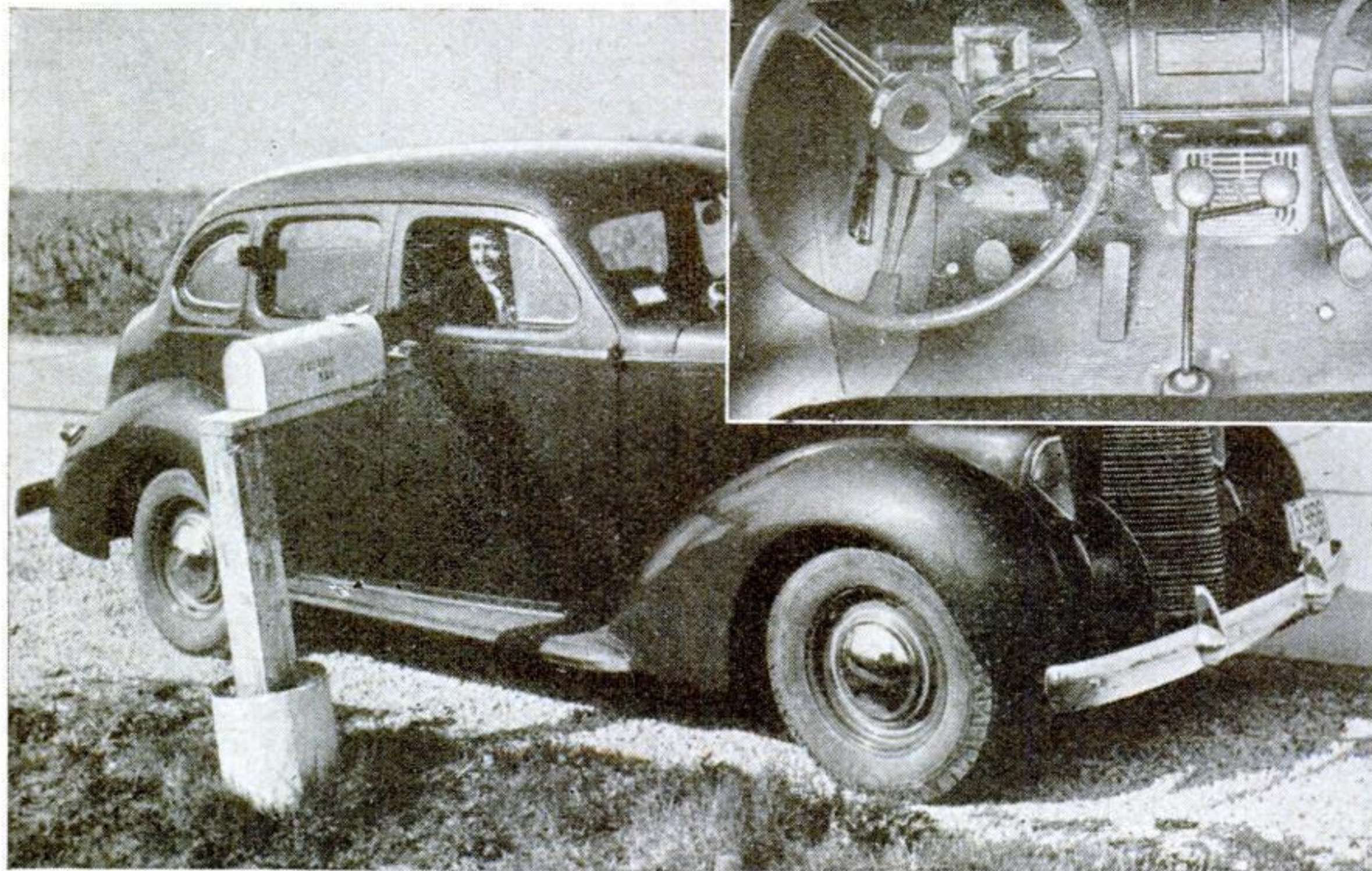
MODELED along the lines of a big newspaper press, an inexpensive toy printer now on the market makes use of a rotary printing cylinder. Rubber type is set by sliding it into ribbed slots on the diminutive rotating cylinder. Self-inking, the small press can print sheets up to three and one half by seven inches, making it practical for printing small menu cards, invitations, announcements, letterheads, and other similar jobs. Lines can be spaced as desired, and since the type fits on the cylinder in only the correct way, it is impossible to make the mistake of printing a line upside down. The unit is sold complete with all accessories, including ink and 400 characters of rubber type. The ingenious toy printer is shown in use at the left.



Postman Uses Dual-Control Automobile

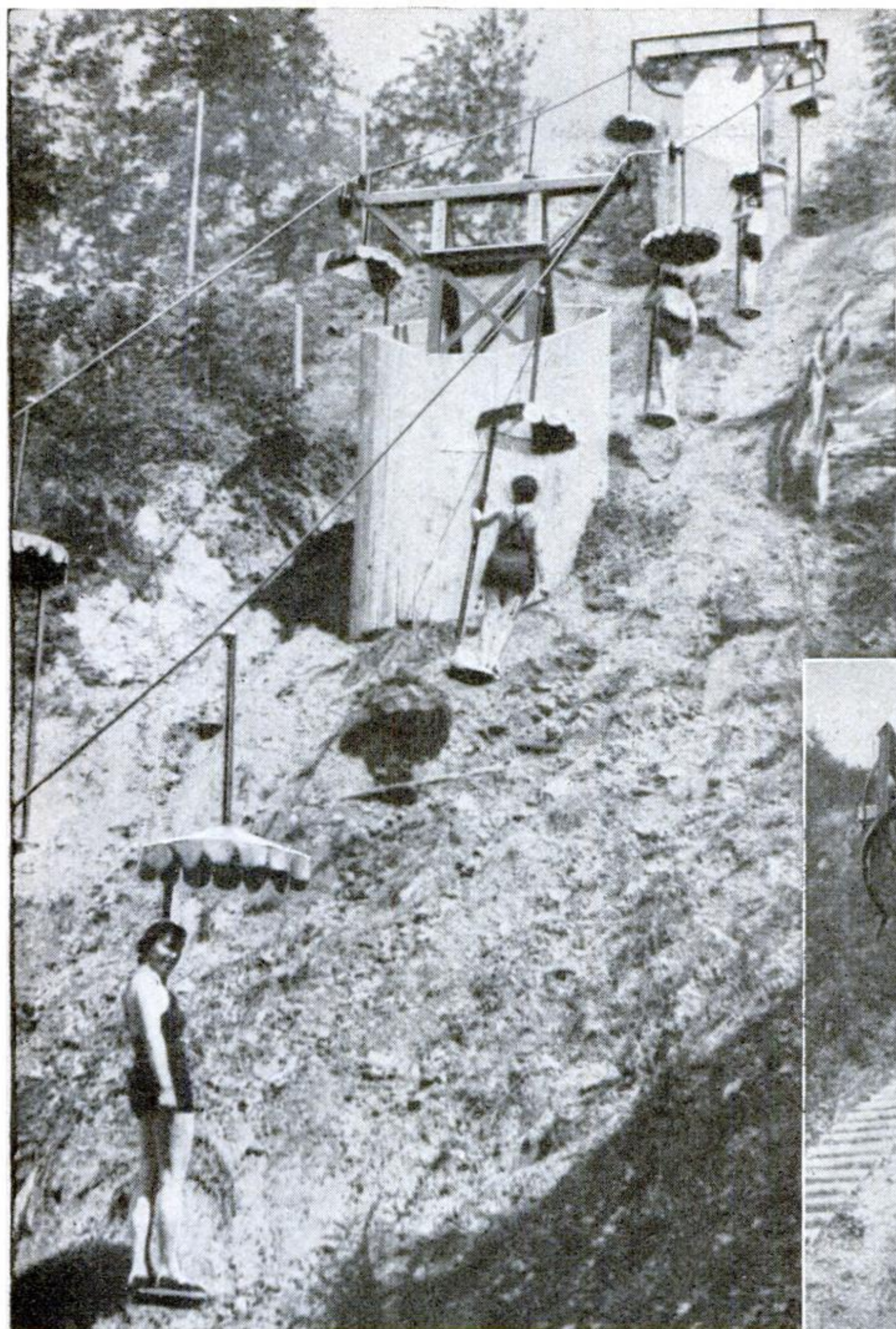
DUAL CONTROLS in the automobile of John Duckwall, Noblesville, Ind., rural mail carrier, simplify his job of placing letters in roadside mail boxes. Operating the car from either the left or right-hand side of the front seat, Duckwall can reach out to insert mail in boxes with a minimum of shifting back and forth from one side of the car to another. The Indiana mail carrier got the idea when he read that an automobile manufacturer was making dual-control cars for special use in driving

instruction and traffic-safety education. The car has two complete sets of foot pedals, dual steering wheels, horns, and rear-view mirrors, and twin knobs on the gear-shift lever.



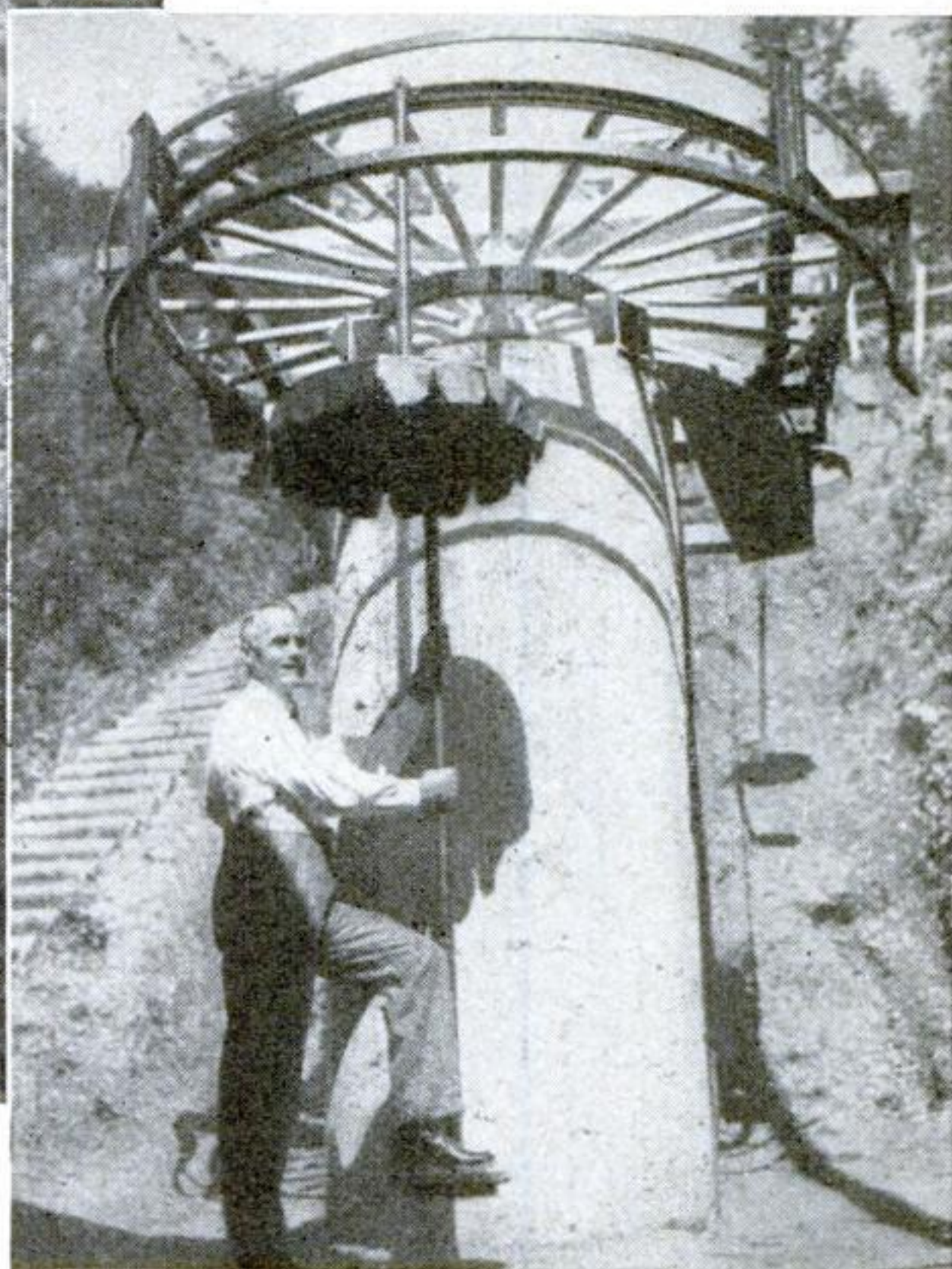
Twin controls allow this postman's car to be driven from either front seat

Duckwall using the right-hand drive to reach a box on the right of the road



Tramway Carries Bathers up Hill

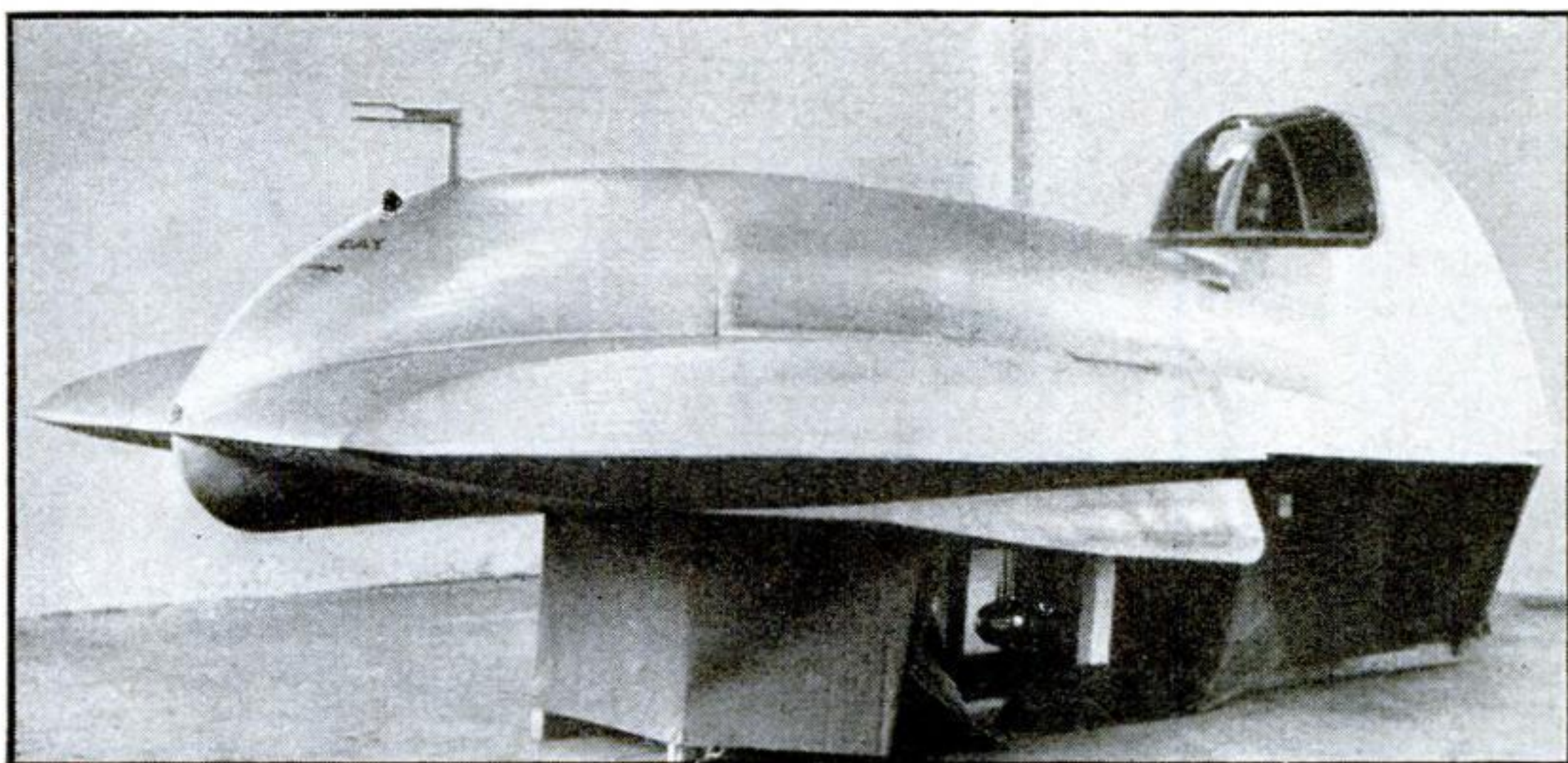
TAKING a hint from the many aerial tramways used to haul skiers up mountainsides, the proprietor of a Swiss hotel installed a novel hoist to carry bathers from the level of a lake, 250 feet up to a sun-bathing lawn near the hotel. Each person steps onto a small, awning-shaded platform which is attached to a motor-driven endless cable that lifts bathers up the hill, as shown at the left.



Bathers riding the hoist from a lake to the sun-bathing lawn on the hill above it. To get a lift, a user steps onto one of the moving platforms, as shown at the right

Odd Streamline Speedboat Resembles a Whale

POWERED by a supercharged engine, the speedboat of radical design pictured at the right has a glass-inclosed racing cockpit so compact that the steering wheel must be removed before the pilot can enter. Built to skim along the surface, the streamline racer is only sixteen feet long, and six feet wide.



This sixteen-foot racer is designed to skim along the surface of the water

Cape Allows Children To Play in Rain



Fastened up the back, the cape fits snugly

BECAUSE two Portland, Ore., mothers wanted their children to get daily airings regardless of rain, they devised the protective cape pictured at the left. Donned over the head, the cape fits snugly around the neck, while the peaked cap ties on over the child's hat.

Sign Protects Slow Driver

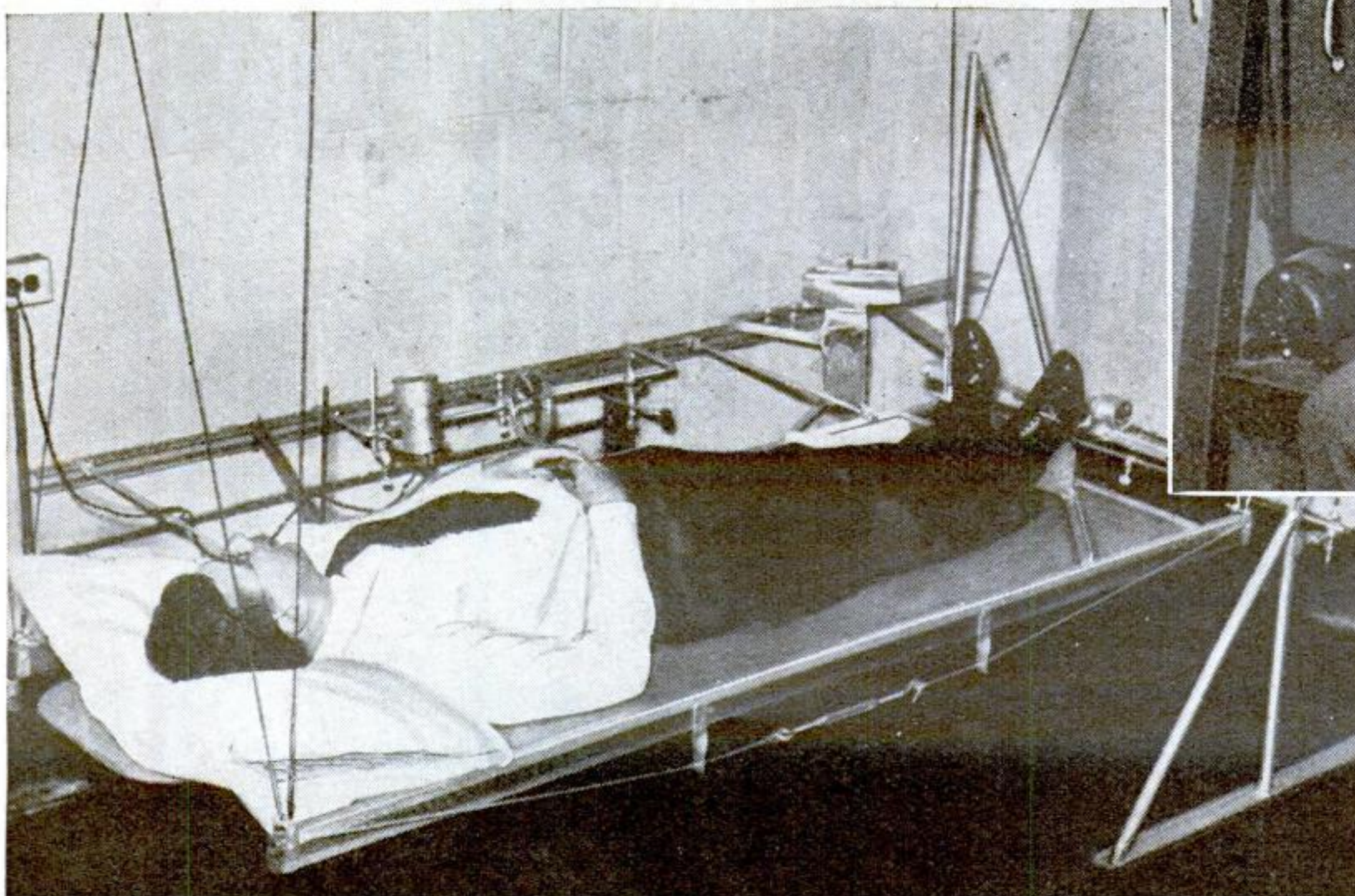
WHEN the installation of a new motor in his automobile forced a Massachusetts motorist to drive at reduced speeds, he spared himself the annoyance of horn-honking drivers on the road behind him by explaining the reason for his slow, traffic-blocking speed on a hand-lettered sign attached to the rear end of his car.



This sign prevents much honking

Balancing Bed Measures Blood Pumped by Heart

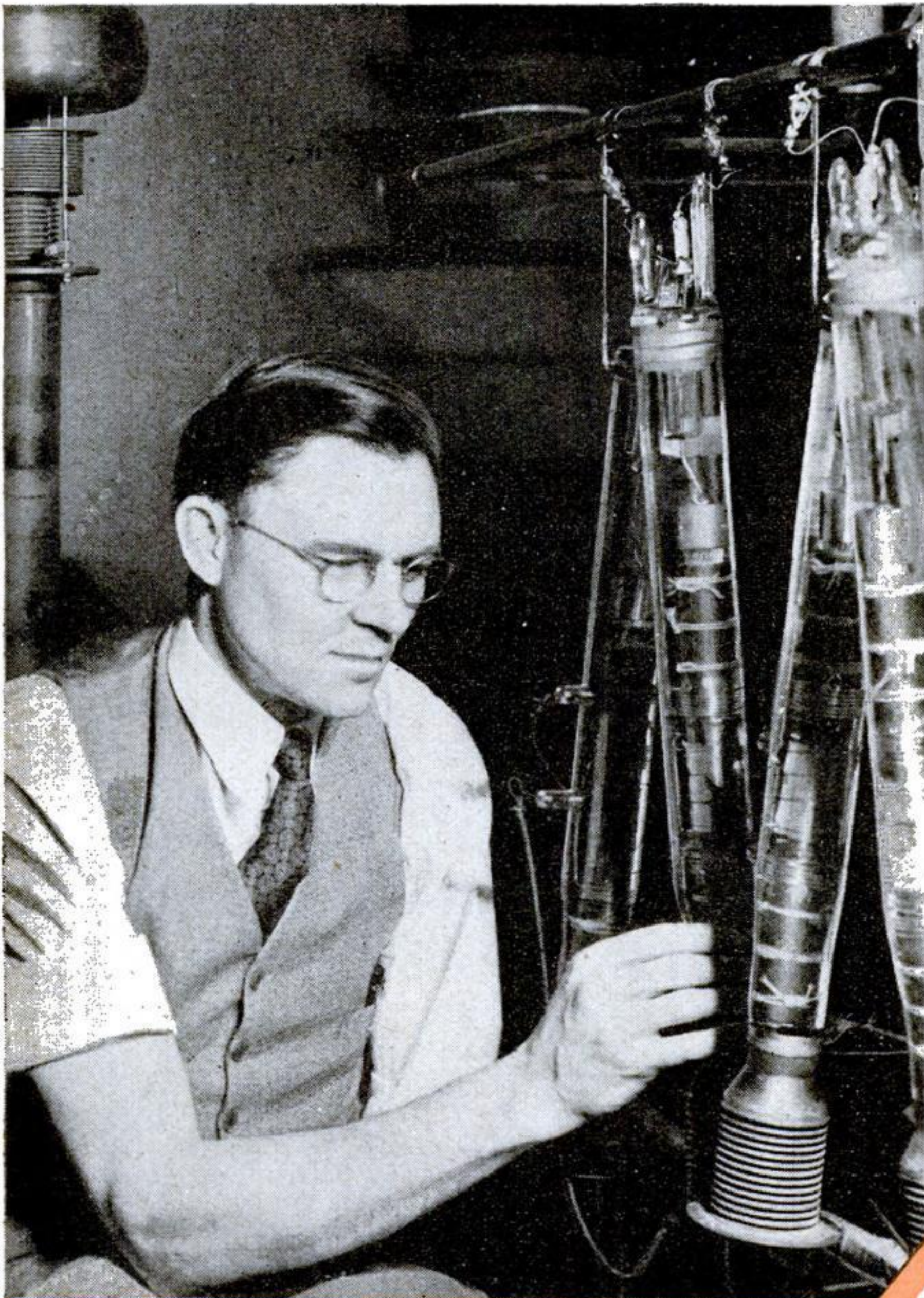
HOW MUCH blood does the heart pump out at each stroke? To answer this question, an important one in diagnosing heart ailments, Dr. Isaac Starr, research scientist at the University of Pennsylvania Medical School, devised the measuring bed, called a cardioballistograph, which is pictured below. When a subject lies on the delicately balanced bed, his heart thumps are registered by a vibrating wire whose shadow is photographed on a motion-picture film. The resulting record is used in computing the flow of blood.



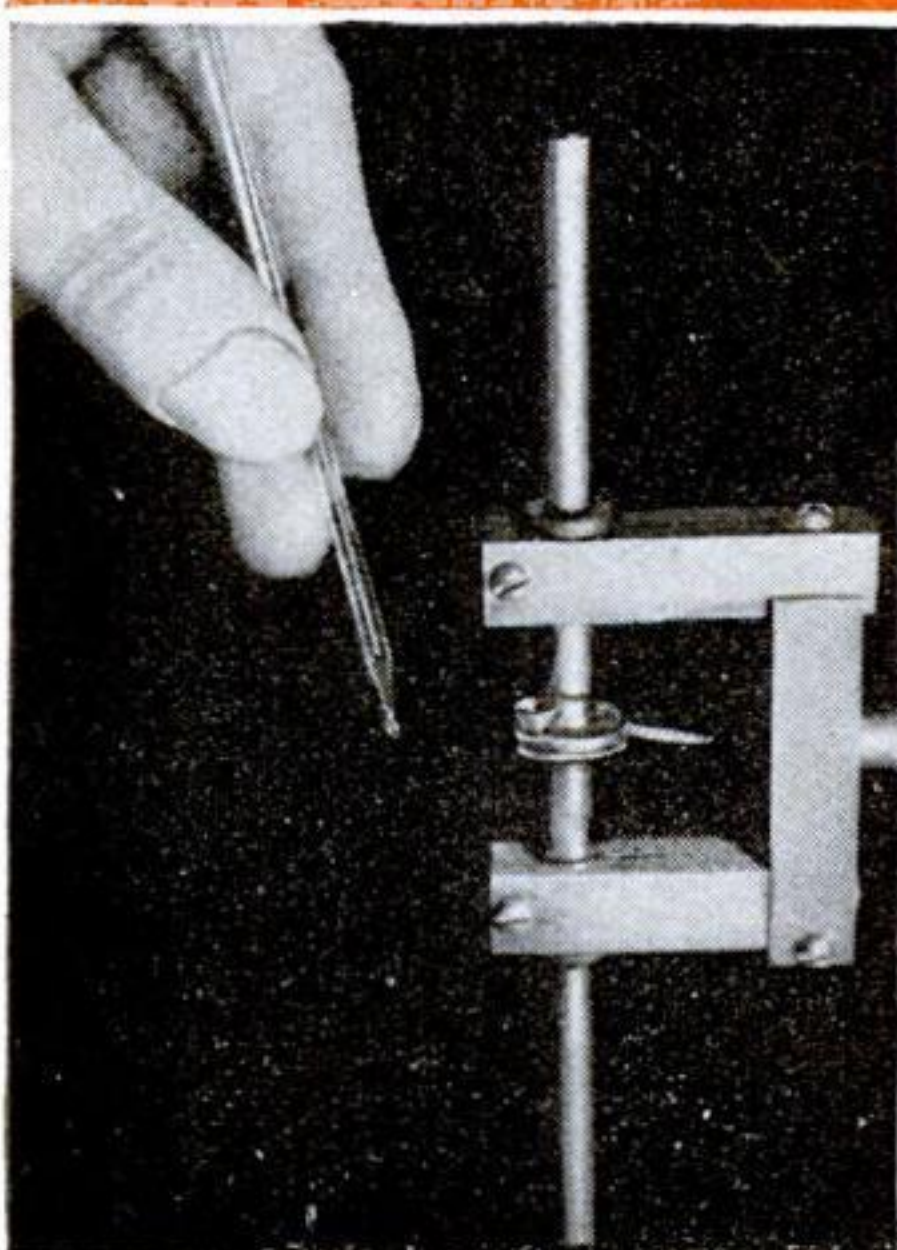
Dr. Isaac Starr watching heart throbs registered on movie film

Left, how a subject lies on the balancing bed for measurement of heart blood output

Fingerprinting Electricity



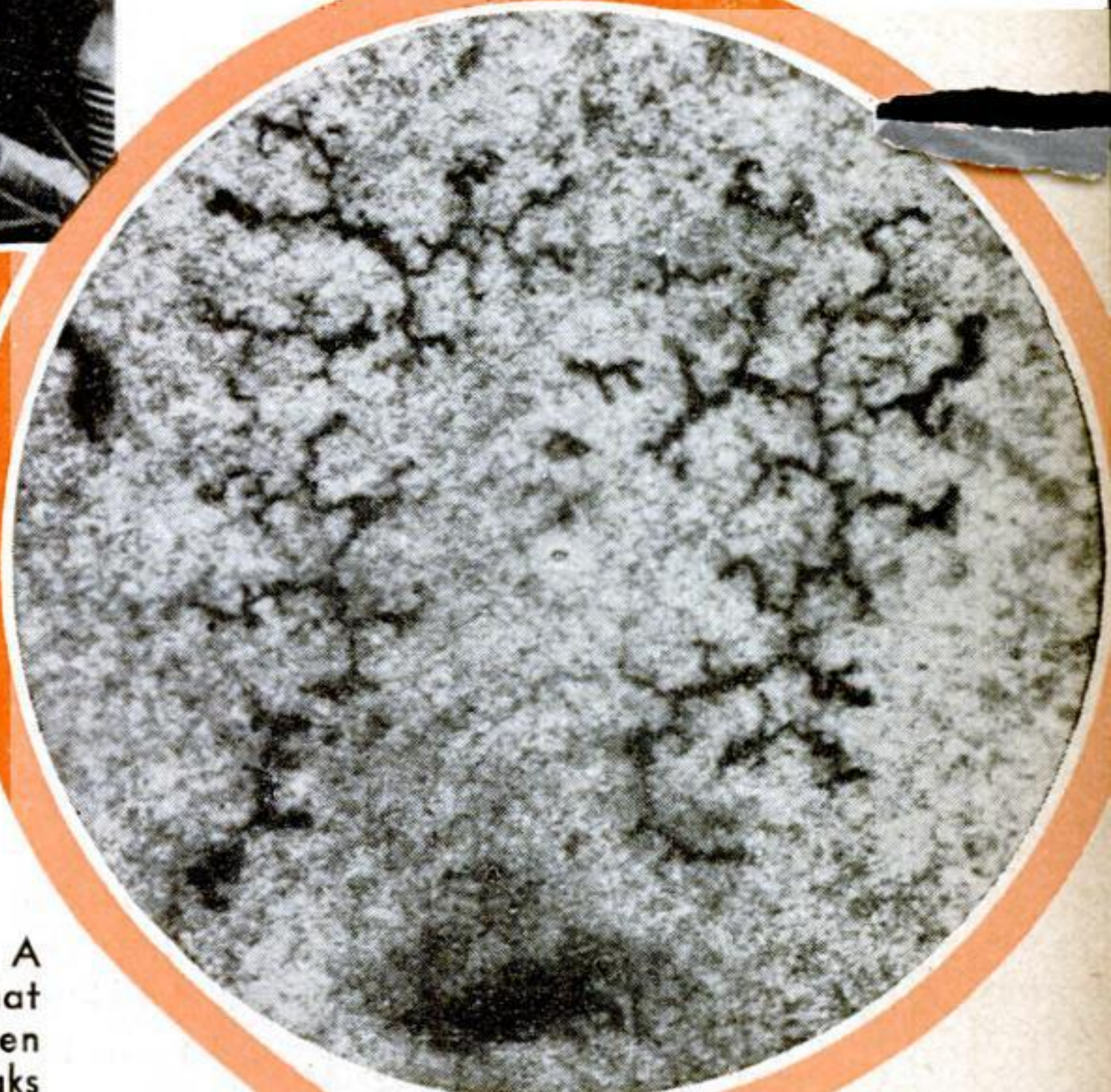
SEARCHING for new and improved insulation for electric cables, Dr. H. H. Race, of the General Electric Research Laboratory, Schenectady, N.Y., is engaged in fingerprinting electricity. By placing small samples of insulated cable under high-voltage stresses, he produces leaks in the insulation—spots where the electricity breaks through and escapes. Study of these spots reveals how the damage takes place. Dr. Race has found that the trails left by the electrons or tiny electrically charged particles show they branch out, spreading over the layers of insulating paper, each only a few thousandths of an inch thick. As the electrons carbonize one spot and burn through to the next layer, they spread out, producing a larger and larger leak until complete failure on the line results. The mineral oil with which the insulating paper is impregnated is also being studied with delicate instruments to determine the effect of the electrons.



Dr. Race and the apparatus he uses to break down the insulation on test cables

Oil from a sample of the insulation under test is checked with the unit at the left

Electricity's fingerprints. A sample of insulation that shows how electrons weaken the paper and cause leaks



Birth

Sculptor Ernesto Peruggi, a prominent designer of dolls, at work in his studio among his creations



1 As the first step in the making of a new doll design, the head is modeled in clay. Peruggi does not use real babies as models, but creates original types



2 When the clay model is completed, plaster of Paris is poured over it to make a mold.

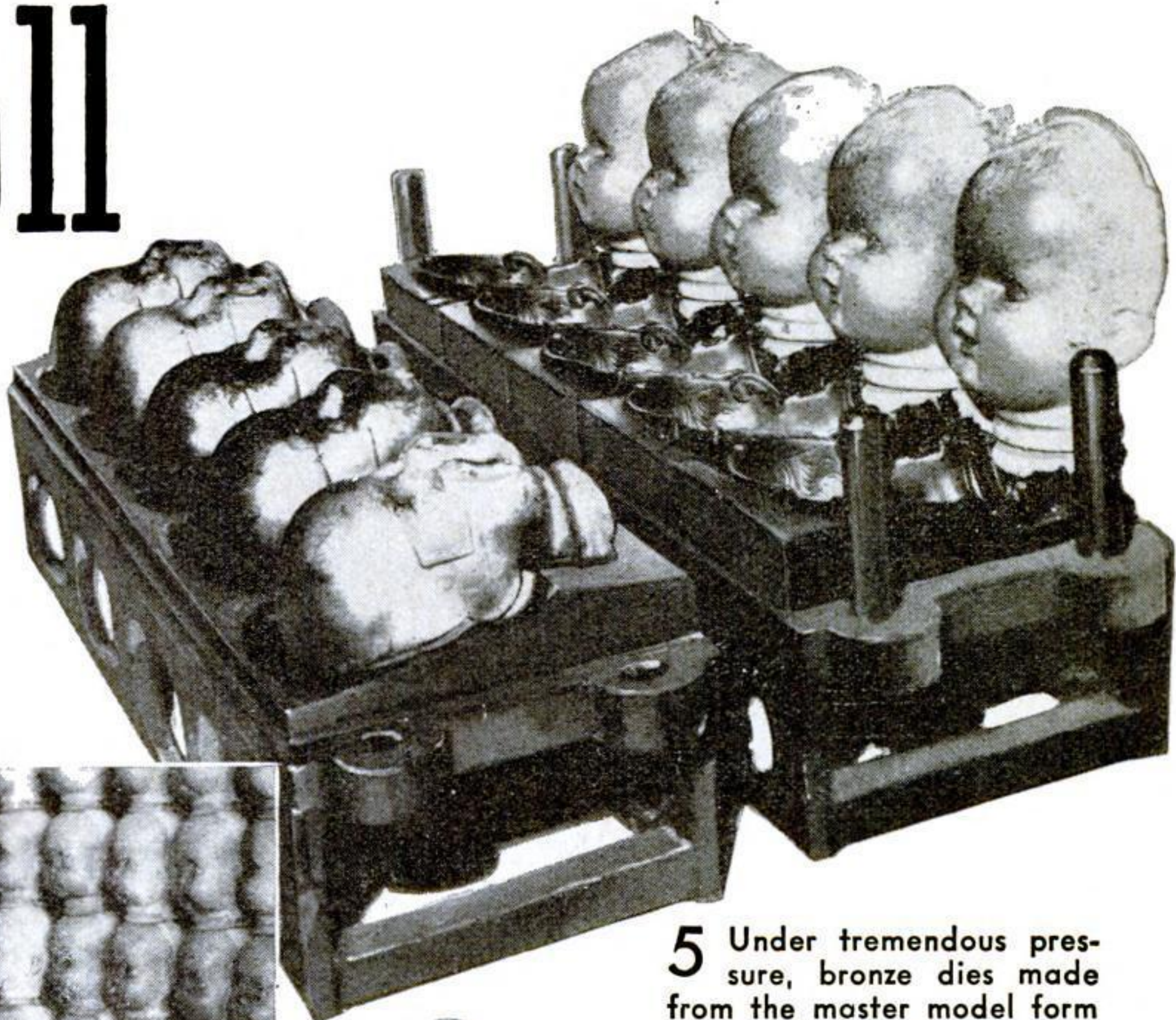
3 After being allowed to harden, the mold is split and removed in two sections. These are tied together and fresh plaster is poured in, as shown at the right. The result is a solid plaster head, which is used as a master model



4 . . . and here it is, ready to leave the artist's hands and go to the factory where mass-production methods take over the job

of a Doll

OUR CAMERAMAN
TAKES YOU TO ONE
OF THE FACTORIES
THAT FILL ORDERS
FOR SANTA CLAUS

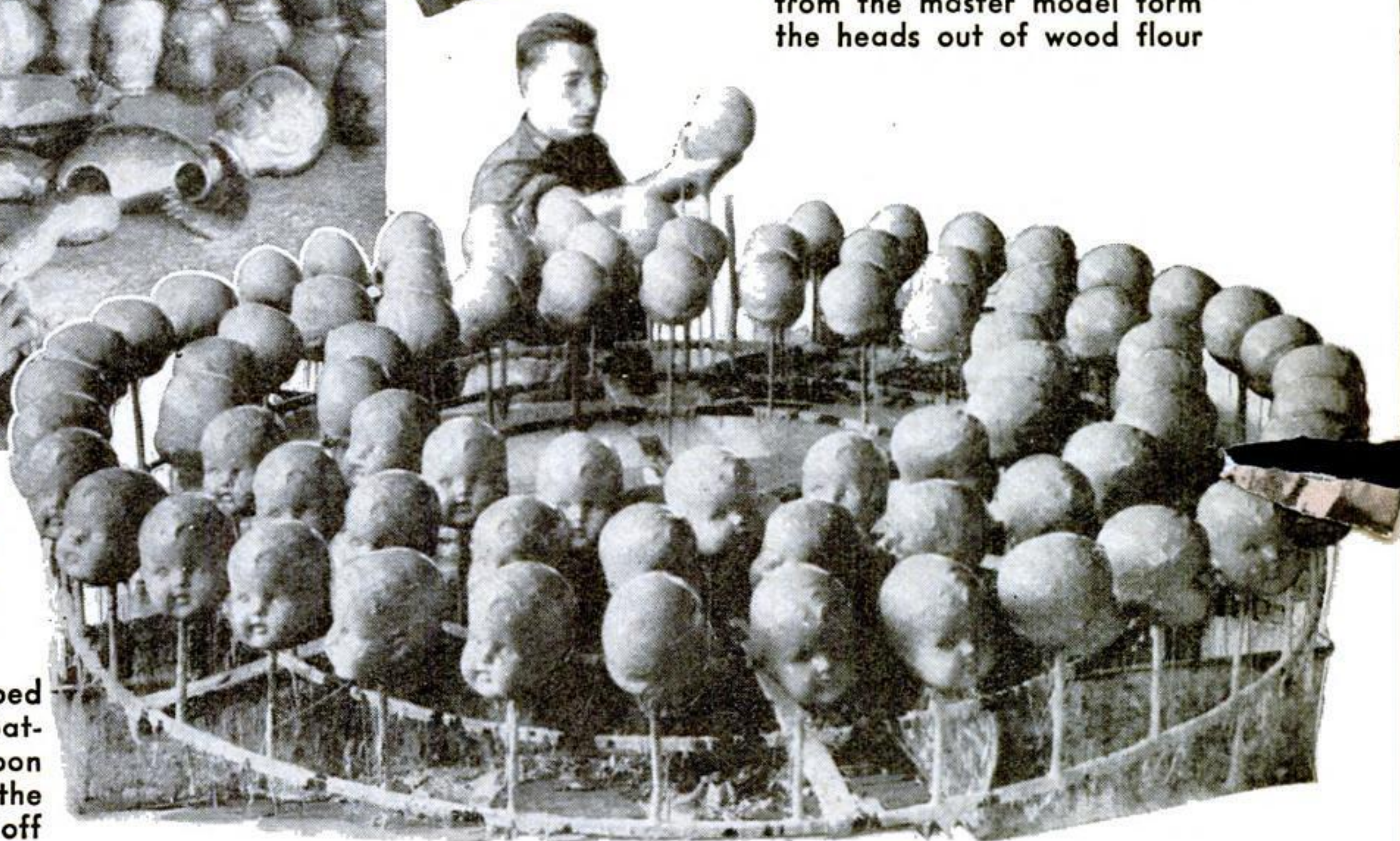


5 Under tremendous pressure, bronze dies made from the master model form the heads out of wood flour



6 Heads and all the other parts are made in hollow, shell-like halves which are later glued together

7 The heads are then dipped into a flesh-colored coating solution and placed upon this revolving rack where the excess solution is drained off

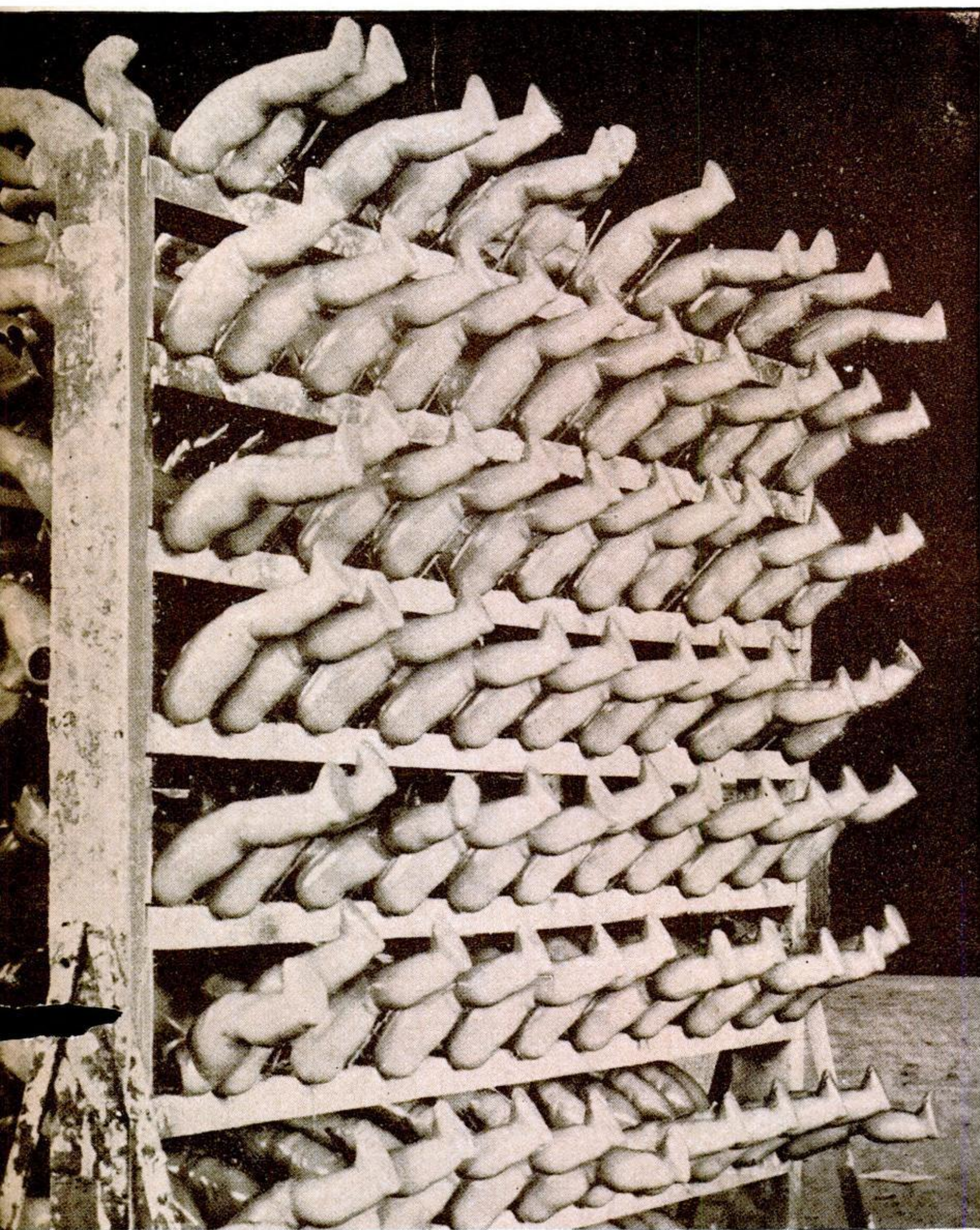


A MERICANS, last year, spent \$25,000,000 for dolls. More than 15,000,000 customers—one in every eight persons in the United States—left stores carrying laughing dolls, sleeping dolls, talking dolls, crying dolls, and other varieties of realistic playthings which taxed the ingenuity of an army of expert toy makers to produce.

During the busy season, tens of thousands of dolls are being born every day, in preparation for the Christmas rush. Great factories in many parts of the country are running at full capacity, turning them out. How they

are designed and made is shown in this set of exclusive photographs which takes you behind the scenes in a great plant where 1,000,000 dolls a year are manufactured.

The life of a doll begins in the studio of one of the half dozen or so sculptor specialists who create the new designs. Ernesto Peruggi, of Brooklyn, N.Y., a leading designer, has been turning out familiar doll heads for more than a quarter of a century. He rarely uses real babies as models. Rather, he strives to create some expression or combination of features which he believes will catch the



8 Legs, arms, and torsos are coated and drained in the same manner as the heads. Here is a rack of legs waiting to be used in the assembly line

public fancy. For years a free-lance designer, Peruggi now works exclusively for the Regal Doll Corporation, of Trenton, N.J., where these photographs were taken.

The original head is modeled in clay. Over it, Peruggi pours plaster of Paris to form the hard, shell-like mold. When this has solidified, he splits it in half, shellacs and greases the interior, fits it together again, and fills it with new plaster of Paris. This produces the model which is presented to the manufacturer after it had been painted realistically.

At the factory, mass-production machines force wood flour into bronze dies made from

the original plaster model. Under great pressure and heat, the wood flour turns into a hard, unbreakable shell. Batteries of these dies in a single machine produce a hundred or more heads at a single operation. All doll parts are produced in sections which, later on, are cemented together in such a manner that the seams are virtually invisible.

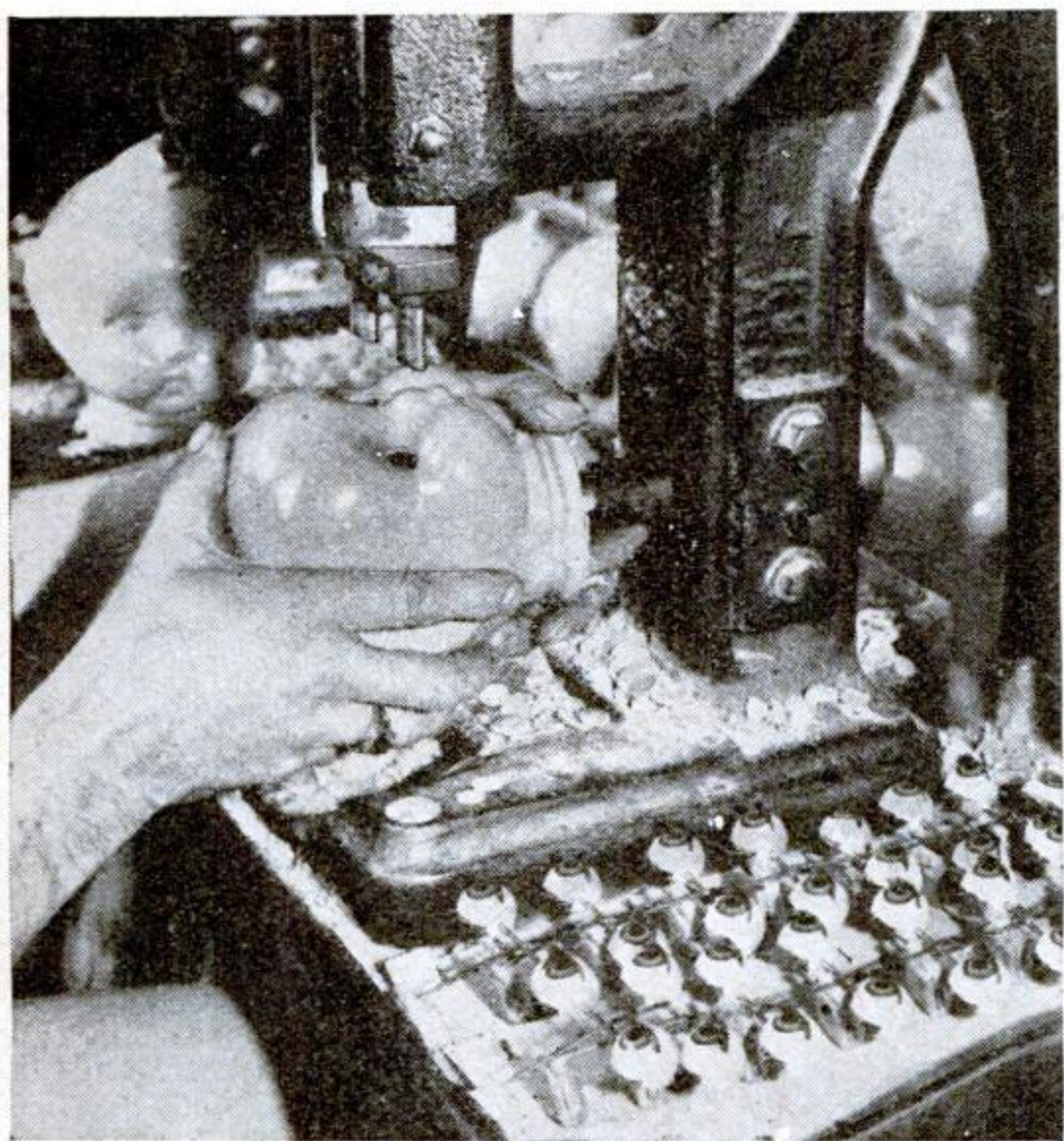
When the cementing together of the section is completed, the parts pass on to great vats filled with a flesh-colored coating solution. After being dipped into this quick-drying fluid, the legs, bodies, and heads of the dolls are placed on revolving racks to dry. As the next step, experts punch holes in the heads and put the eyes in place. Other workers paint on the eyebrows and lips.

In another department, skilled hairdressers are using wax and tiny curling irons to give the hair of the doll wigs realistic waves and curls. Meanwhile, scores of dressmakers are cutting cloth and running sewing machines, turning out the miniature dresses, which look exactly like those worn by children today. Doll manufacturers are careful to keep step with chang-

ing fashions, as modern children insist on a great deal of realism in their playthings.

The final stage in the creation of a doll is to assemble the head, arms, legs, and torso. Then each doll is carefully dressed, in much the same manner as a real baby would be. Packed in an attractive box, it is ready for shipment to the retail dealer and for display on his counter.

This sequence of events, which began with the making of the master model in the sculptor's studio, comes to an end in a toy store, where the finished doll is ready to add hours of happiness to the life of a child.



9 In the meanwhile, heads go to the optical department, where holes are punched in the faces to receive the realistic glass eyes. In the photograph at the left, a tray of eyes can be seen on the bench beside the machine punch



10 Next stop is the beauty shop, where a skillful make-up artist paints lips and eyebrows with a hand brush



11 Expert hairdressers, using miniature curling irons, put permanent waves in the dolls' wigs. Mohair is used instead of real hair, being stronger



12 The final step is to dress the dolls with tiny garments prepared by a staff of dressmakers. A modern doll's clothes are carefully patterned after those worn by real children, and well made

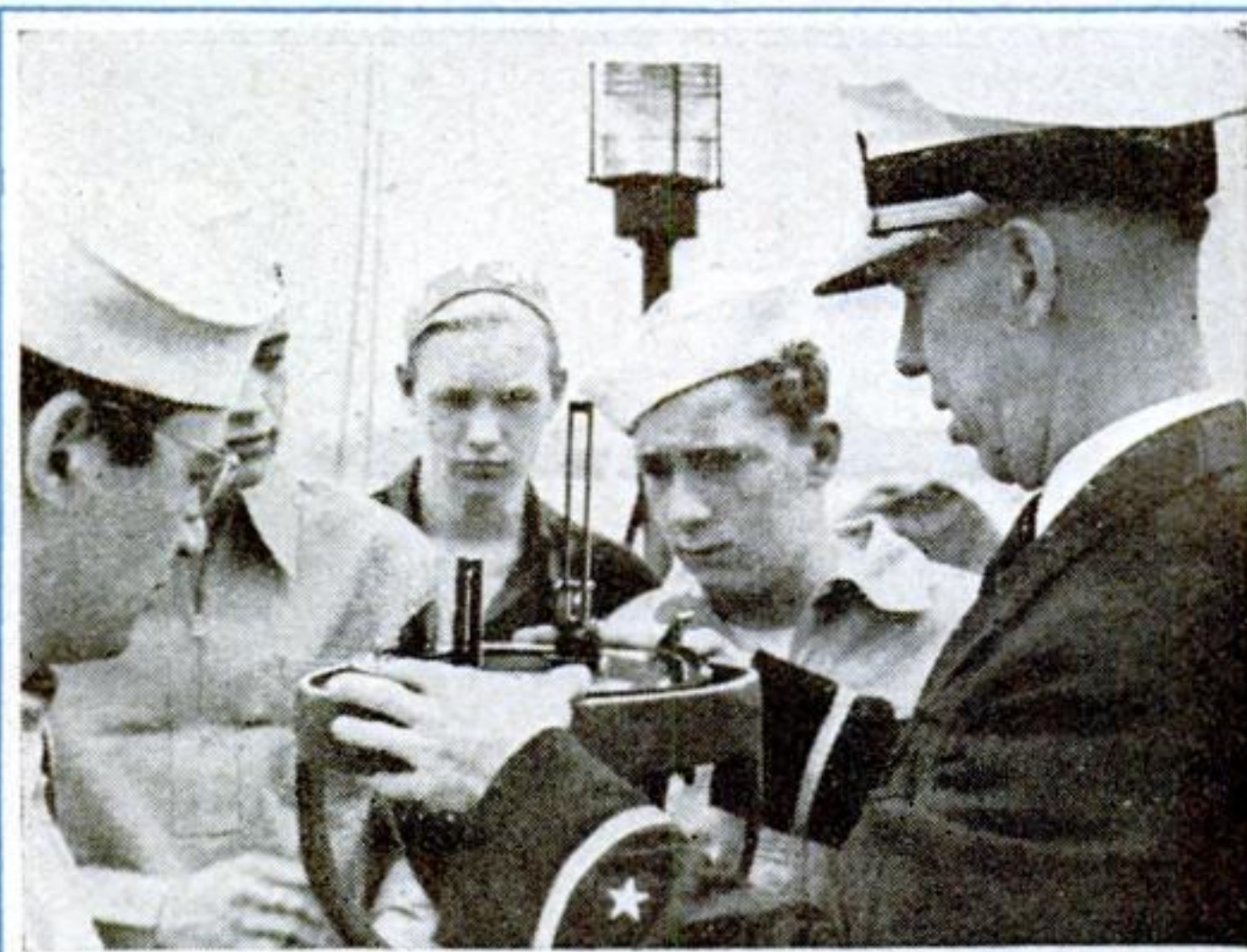
High School of

With All New York Harbor for a Classroom, a Novel Vocational Course Turns Boys into Seamen

By KENNETH M. SWEZEY



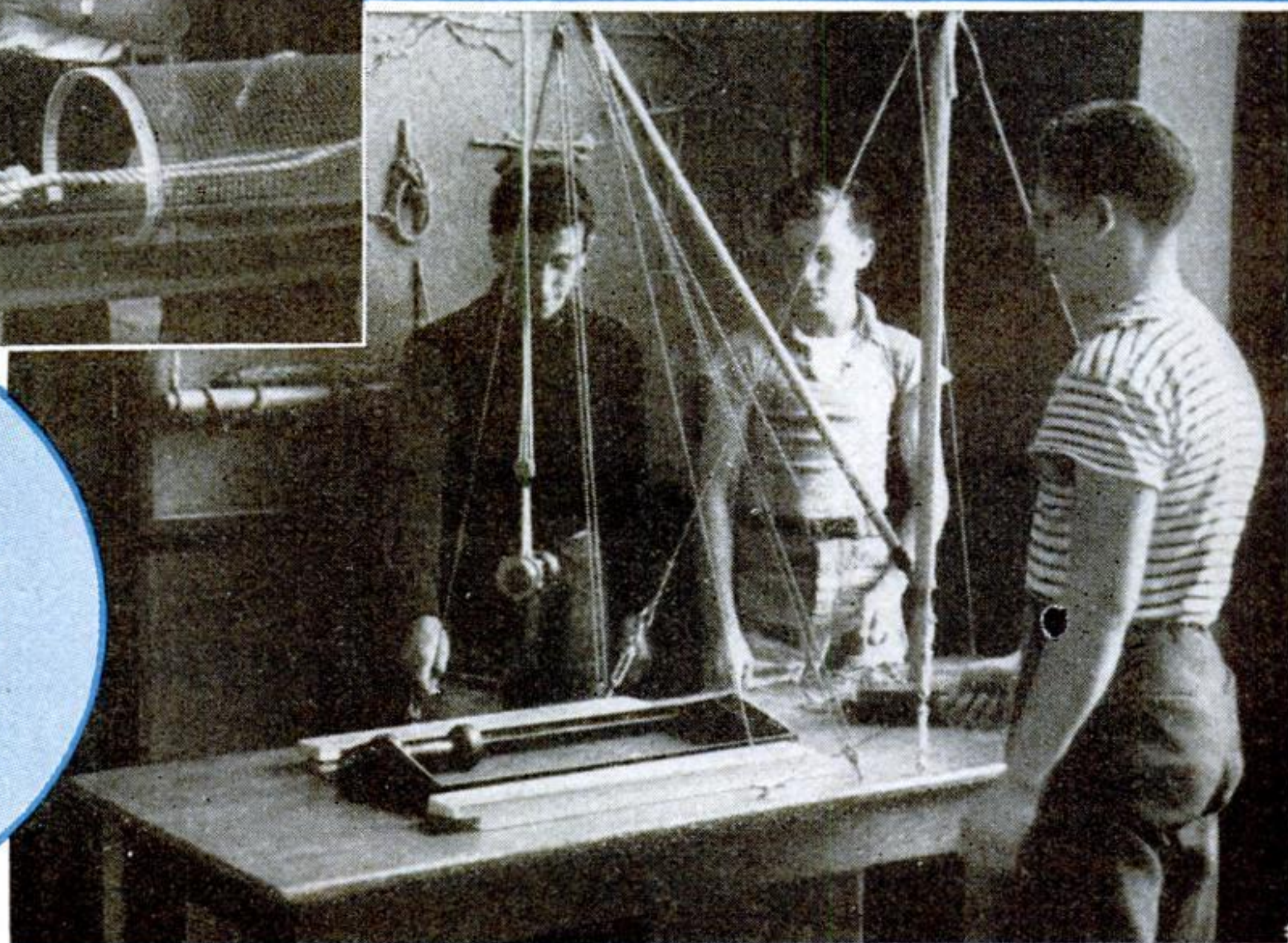
This boy is learning to be a seaman in a unique nautical high school



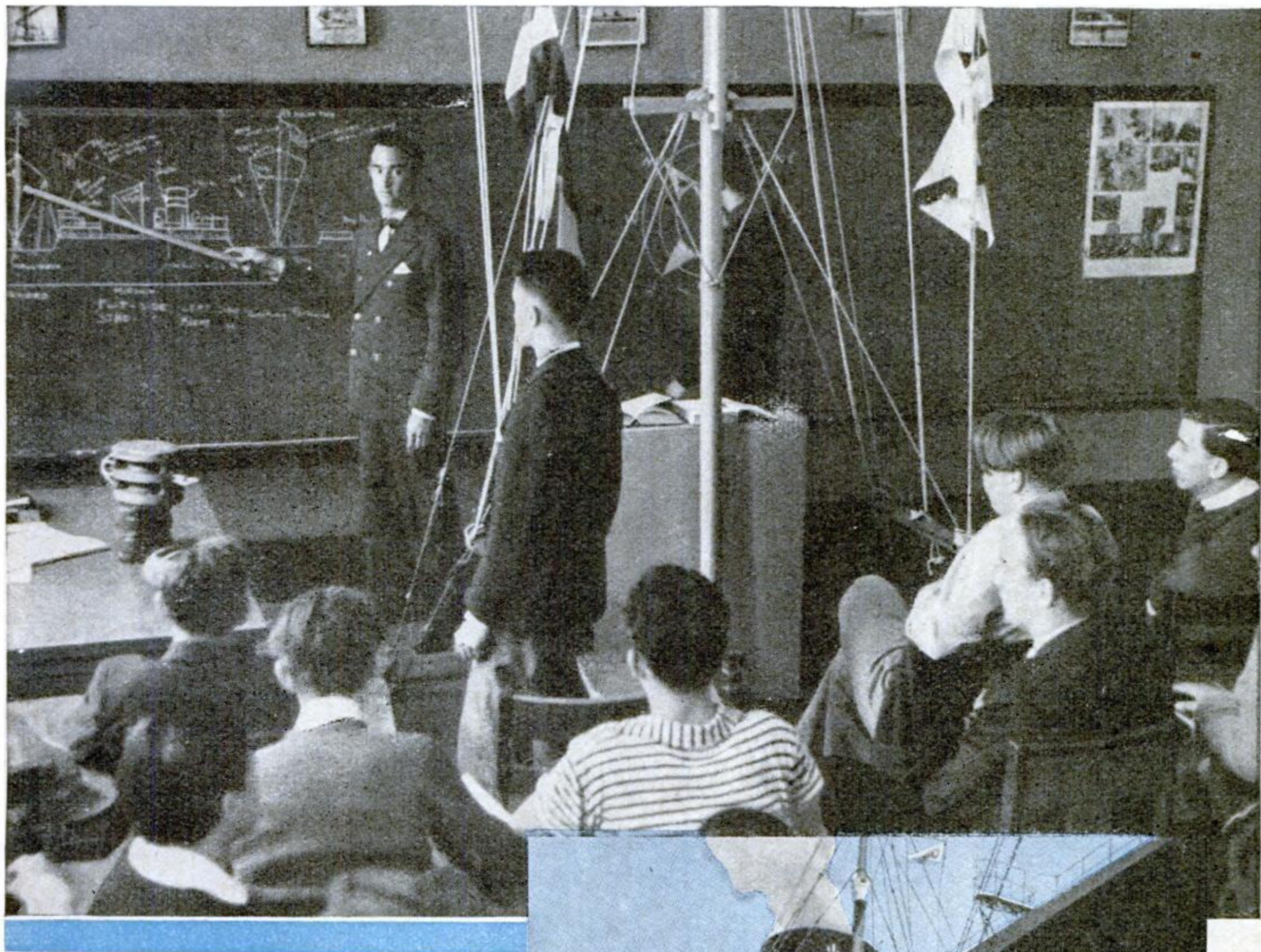
Third Officer Dollar of the S. S. "Acadia" explains the use of the pelorus, an instrument for taking bearings visually, to a group of future maritime workers



Knots tied by students are tested by the machine shown above, to determine the force required to make them slip or break. Right, a model boom and hatch are used to illustrate the method of maneuvering cargo into the hold of a steamship



the High Seas



Capt. Joseph Schelling, a merchant-ship master, teaching boys the names of the various parts of a typical cargo vessel

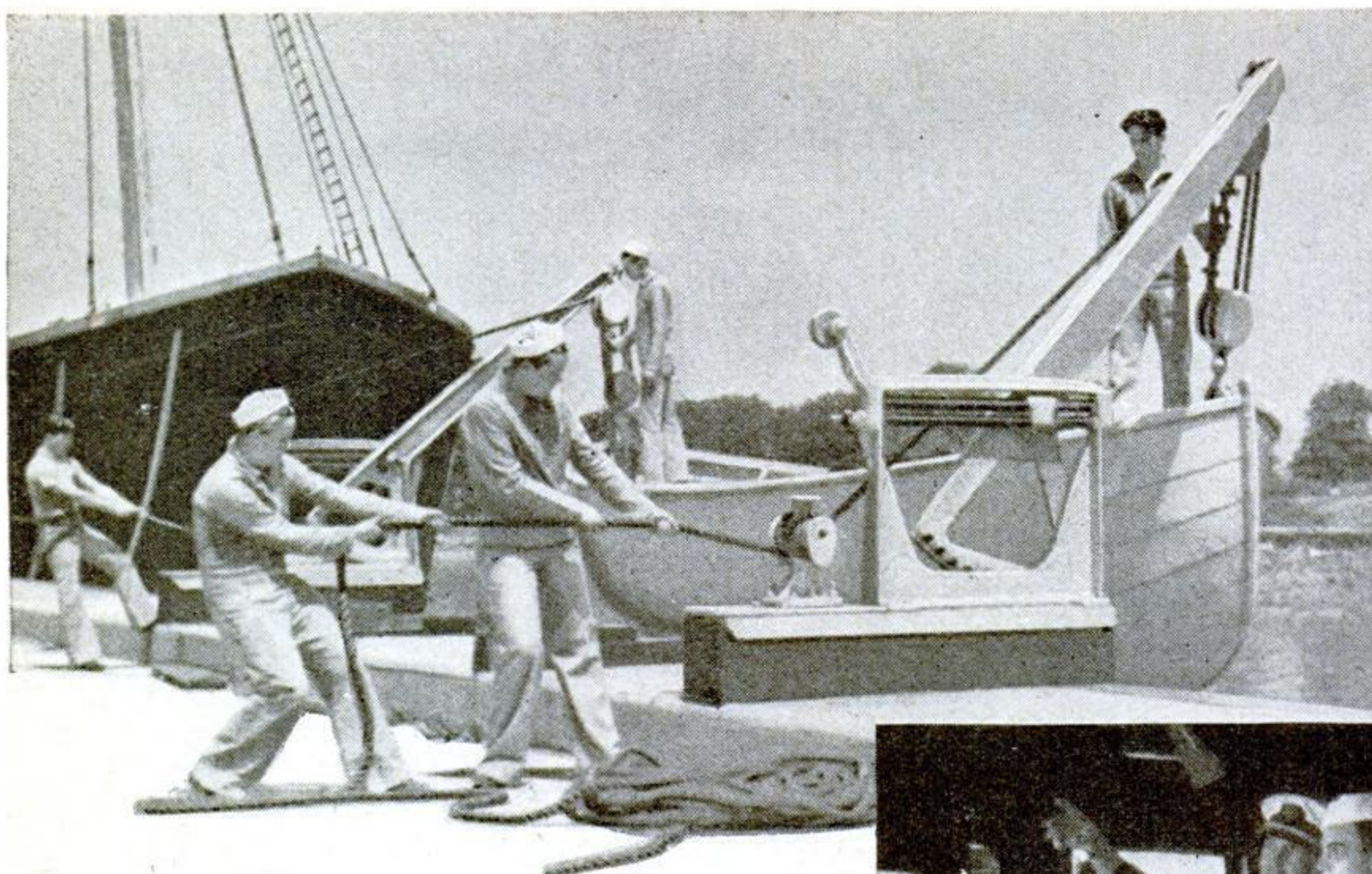
TO TRAIN sea-minded boys for all occupations connected with the American merchant marine, one of the most unusual of high-school courses has just been instituted in New York City. With licensed, experienced sea captains for teachers, subjects like cargo stowing, knot tying, and the basic principles of ship design go hand in hand with the more conventional ones of English, physics, and mathematics. What would-be sailors learn in the classroom, they lose no time in putting into practice, for a substantial part of their course consists of actual work aboard the tugs, freighters, and passenger liners that ply the waters of New York Harbor.

Ingenious mechanical aids make the classroom lessons vivid. A pupil need have no uncertainty about the strength of knots and



Aboard a New York Harbor tug, students watch the giant liner "Normandie" being nudged out into the North River

splices he has made, for a testing machine shows exactly how much force is needed to make them slip or break. A working model demonstrates all the details of cargo handling and hatch maneuvering, while other models illustrate important factors in ship construction and stability. Fire drills, and lifeboat drills with regulation lifeboats, help teach the working rules of sea safety. Major sea disasters of the past come up for analysis and



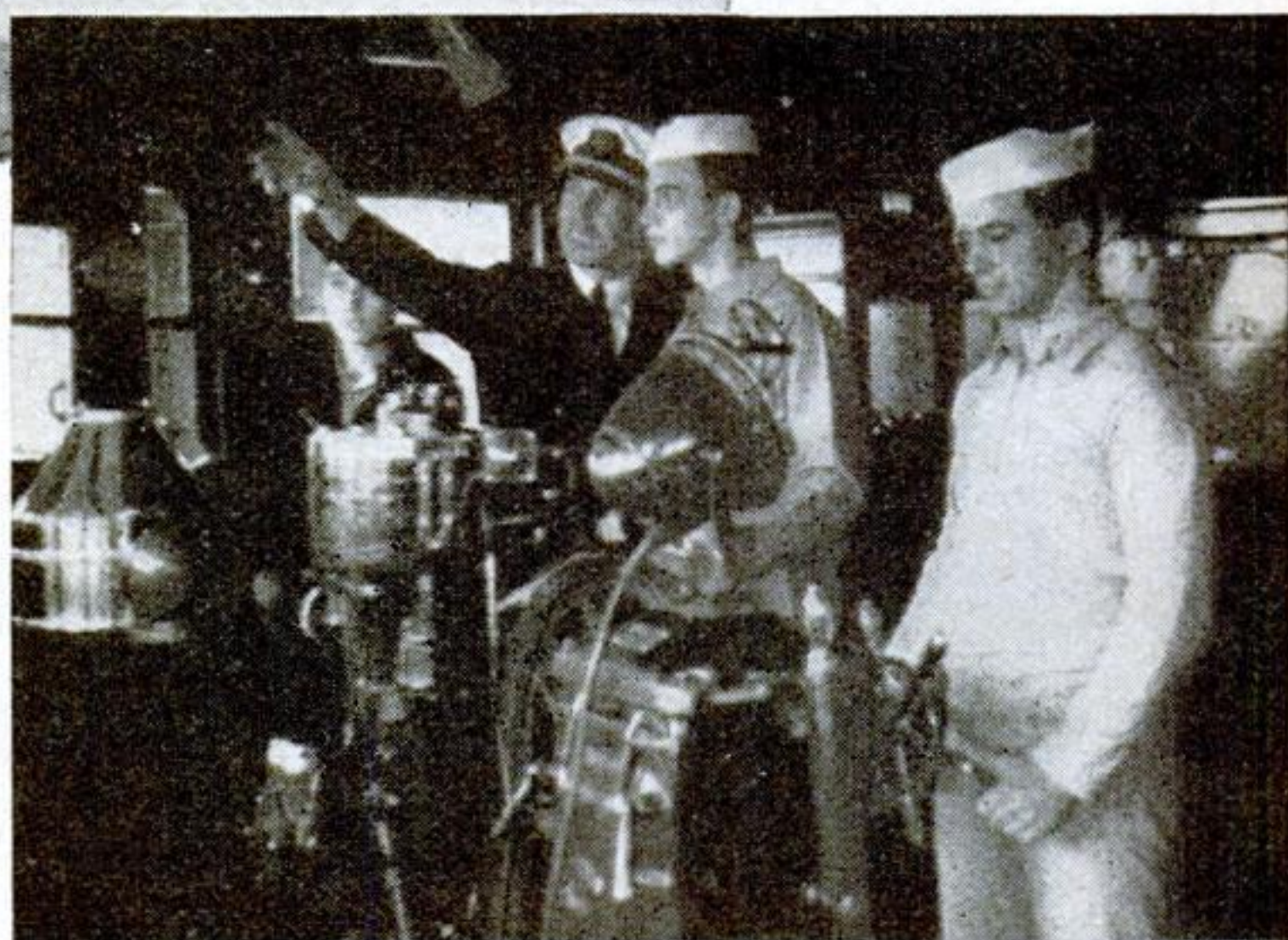
Training includes fire and lifeboat drills. These boys are adjusting the tackle on a standard lifeboat as part of the school routine

All New York Harbor is their classroom. Below, students are getting some tips on steering a ship, on the bridge of a vessel lying at her berth

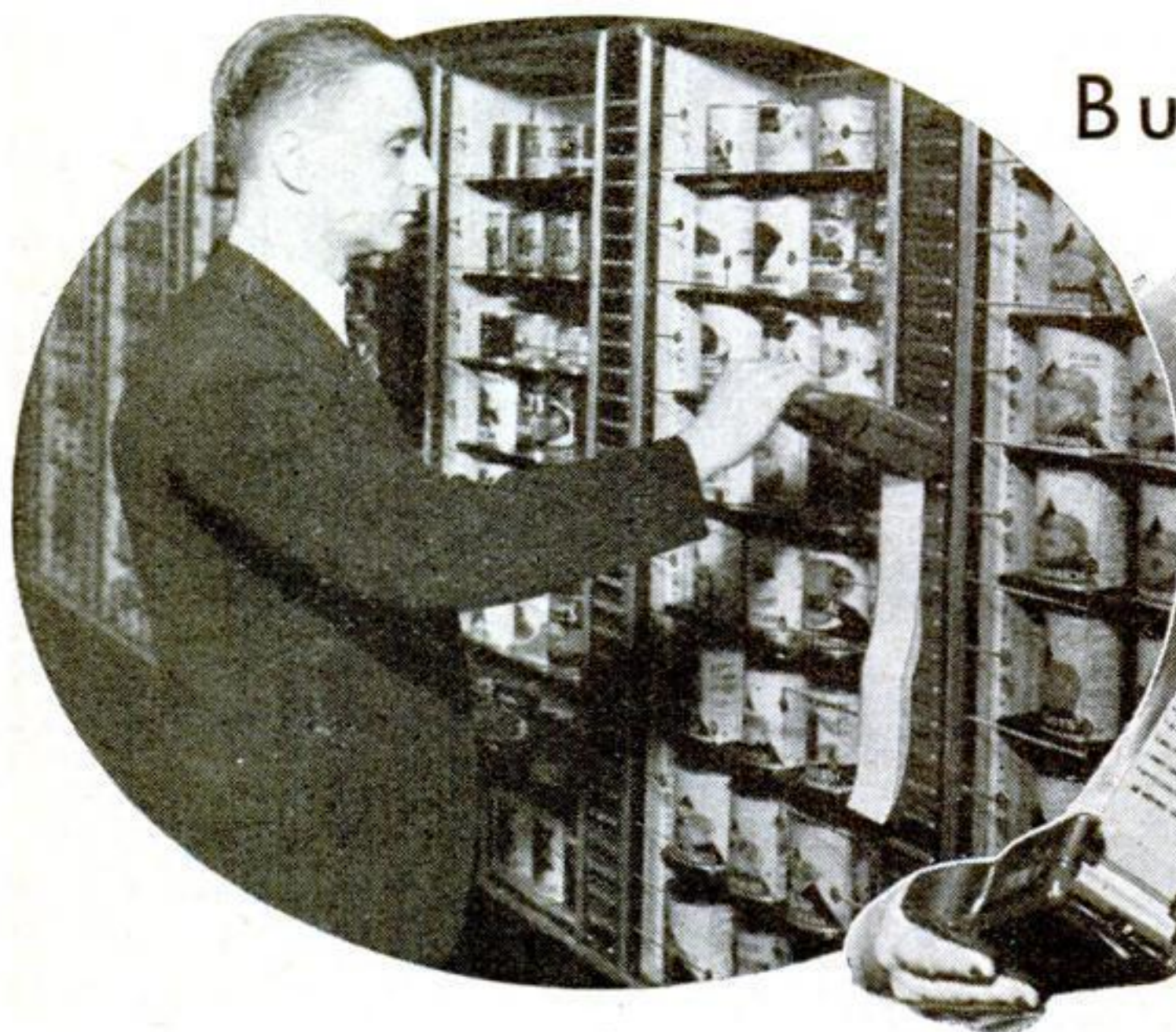
discussion as object lessons in sea safety.

Nautical schools that train high-school graduates to become deck and engineer officers have long been sponsored by the states of California, Massachusetts, New York, and Pennsylvania. The new course, offered by the Metropolitan Vocational High School in New York City and developed with the cooperation of the New York City Board of Education and the Maritime Association of the Port of New York, does not aim to duplicate the work of these schools. Open to any boy with an elementary school diploma, it fits him to become an expert seaman, an engine-room assistant, a steward, or a capable office worker for a steamship line—jobs that previously could be learned only by hard experience. It also gives him a well-rounded education in regular high-school subjects.

Upon completing the four-year course, if he is able and wants to, a student may continue his training at one of the nautical



academies. If this is not practicable, the graduate may get a job aboard a ship and work his way up to the post of a licensed officer by experience and service. Shipping companies are watching the experiment with keen interest, and already a number of them are reported to be bidding for future graduates, with the idea of recruiting their crews with young men who have a genuine love of the sea, and a valuable preliminary schooling.



Buyer Takes Own Order

Patron selecting groceries. Stencils on the wall print items in the list, as pictured above

CUSTOMERS in an odd Memphis, Tenn., grocery select items by pressing a paper tape contained in a metal holder against a line of type on the wall near the glassed-in foods they desire. When a patron has completed his selections, a cashier takes the printed tape, adds up the prices stamped beside the items, and sends a clerk to fill the order.

Motor-Driven Hand Tool Throws Dirt on Flames

POWERED by a compact gasoline engine suspended from straps around the shoulders of a fire fighter, a portable hand tool invented by John Raleigh of Peshtigo, Wis., combats forest fires by digging up dirt, sand, or gravel and throw-

ing it onto the flames. Whirled by means of a flexible shaft connected to the motor, an augerlike digging mechanism loosens the soil, feeding it to the blades of a revolving fan which hurl the dirt outward through a slot in the hood at the base of the apparatus, as pictured below.



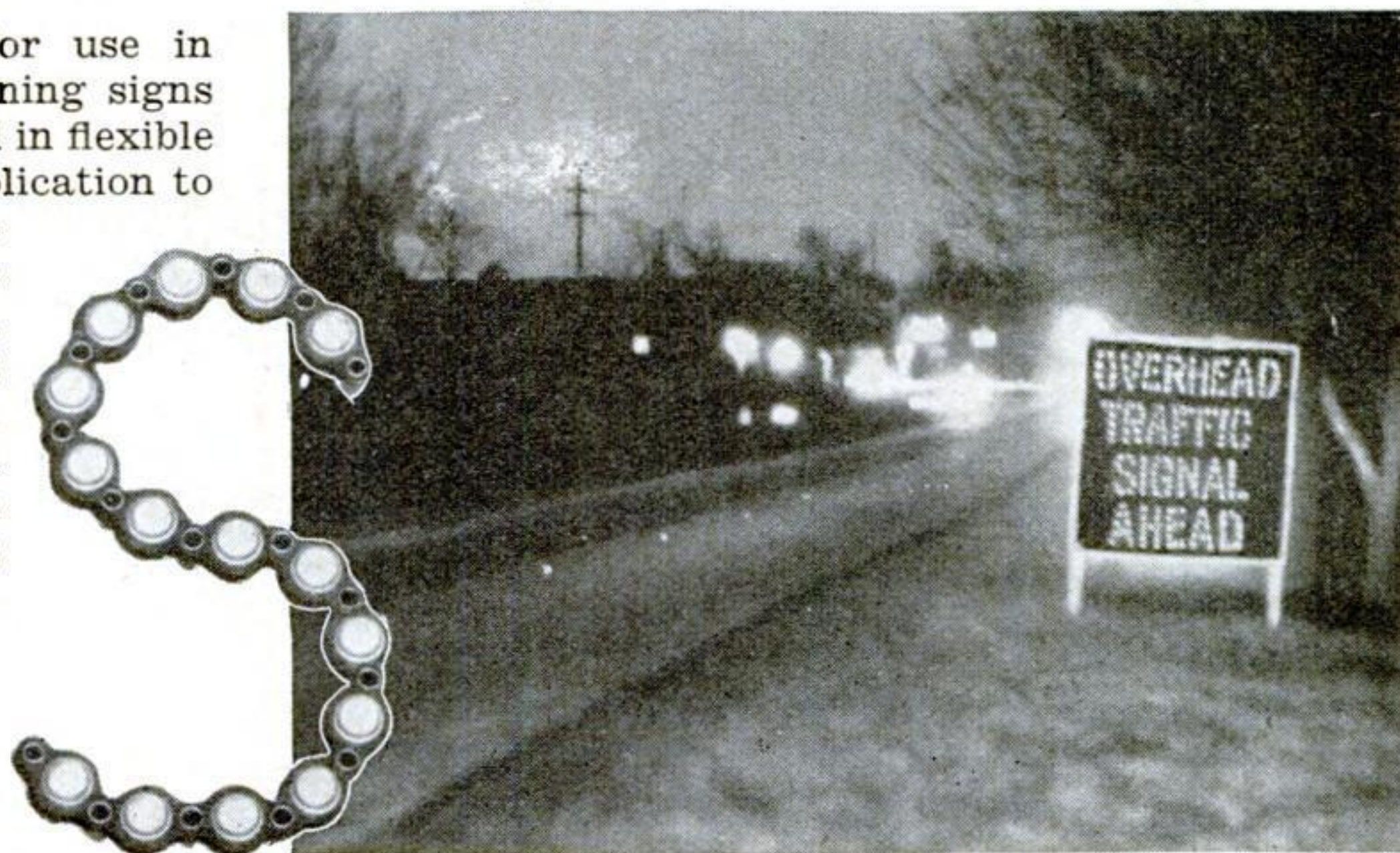
Rotary blades, driven by a gasoline engine carried on the back, scoop up sand or soil

ROTARY FAN "SPRAYS" DIRT OUT THROUGH OPENING

Linked Reflector Buttons Spell Out Road Signs

REFLECTOR buttons for use in making highway warning signs are now available mounted in flexible linked chains for easy application to wood or metal bases. Letters or symbols in any size can be quickly formed with the chain reflectors and attached with nails, rivets, or screws inserted into eyelets between the buttons. Reflecting units are made in various colors.

Chains of reflector buttons are bent to form warning symbols or letters for highway signs





TEX RANKIN CAN DO MORE THRILLING THINGS WITH
AN AIRPLANE THAN ANY OTHER MAN IN THE WORLD



King of the

By
Andrew R.
Boone

Tex Rankin in the cockpit of his acrobatic monoplane. The drawing shows some of the 126 maneuvers he carries in his bag of tricks

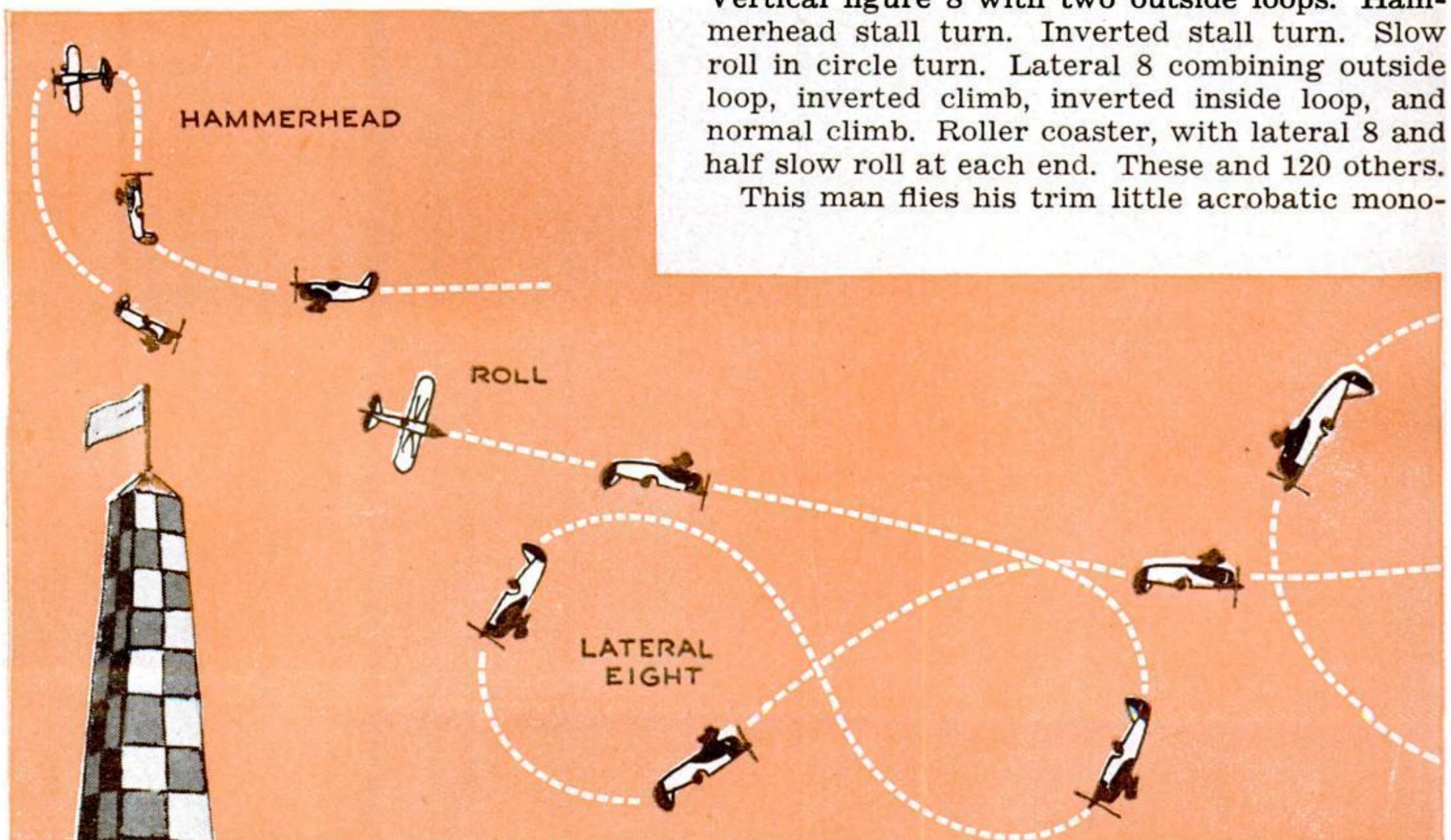
HOW would you like to fly 300 miles an hour upside down in an airplane, your head almost scraping the ground? Chances are you wouldn't. Yet this thrilling air stunt, and scores of others just as breath-taking, may be accomplished with comparative ease after, say, ten years of practice.

Ask Tex Rankin. He knows. Rankin performed his first intentional acrobatic

maneuver in an airplane nineteen years ago. Since then he has flown to fame as a precision aërobat. He counts 126 aerial tricks in his repertoire. In addition to holding the world's record for outside loops, 131 during a single flight, he is the international stunting champion.

Rankin probably can make an airplane do more tricks than any other living man. Were he to leave a trail of smoke as he performs his hair-raising evolutions, you would see a multitude of complex patterns spread across the sky. Vertical figure 8 with two outside loops. Hammerhead stall turn. Inverted stall turn. Slow roll in circle turn. Lateral 8 combining outside loop, inverted climb, inverted inside loop, and normal climb. Roller coaster, with lateral 8 and half slow roll at each end. These and 120 others.

This man flies his trim little acrobatic mono-



Stunt Flyers

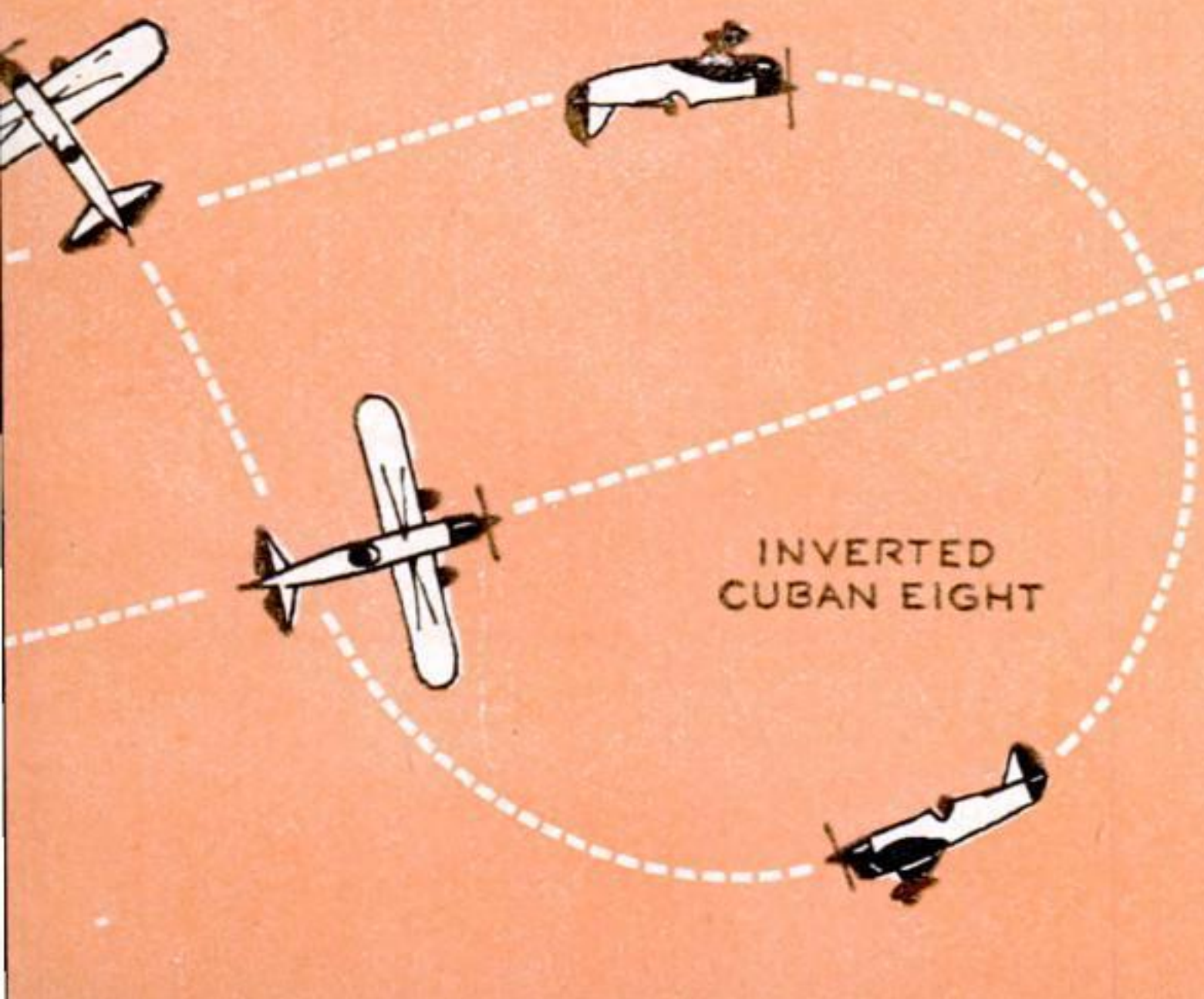
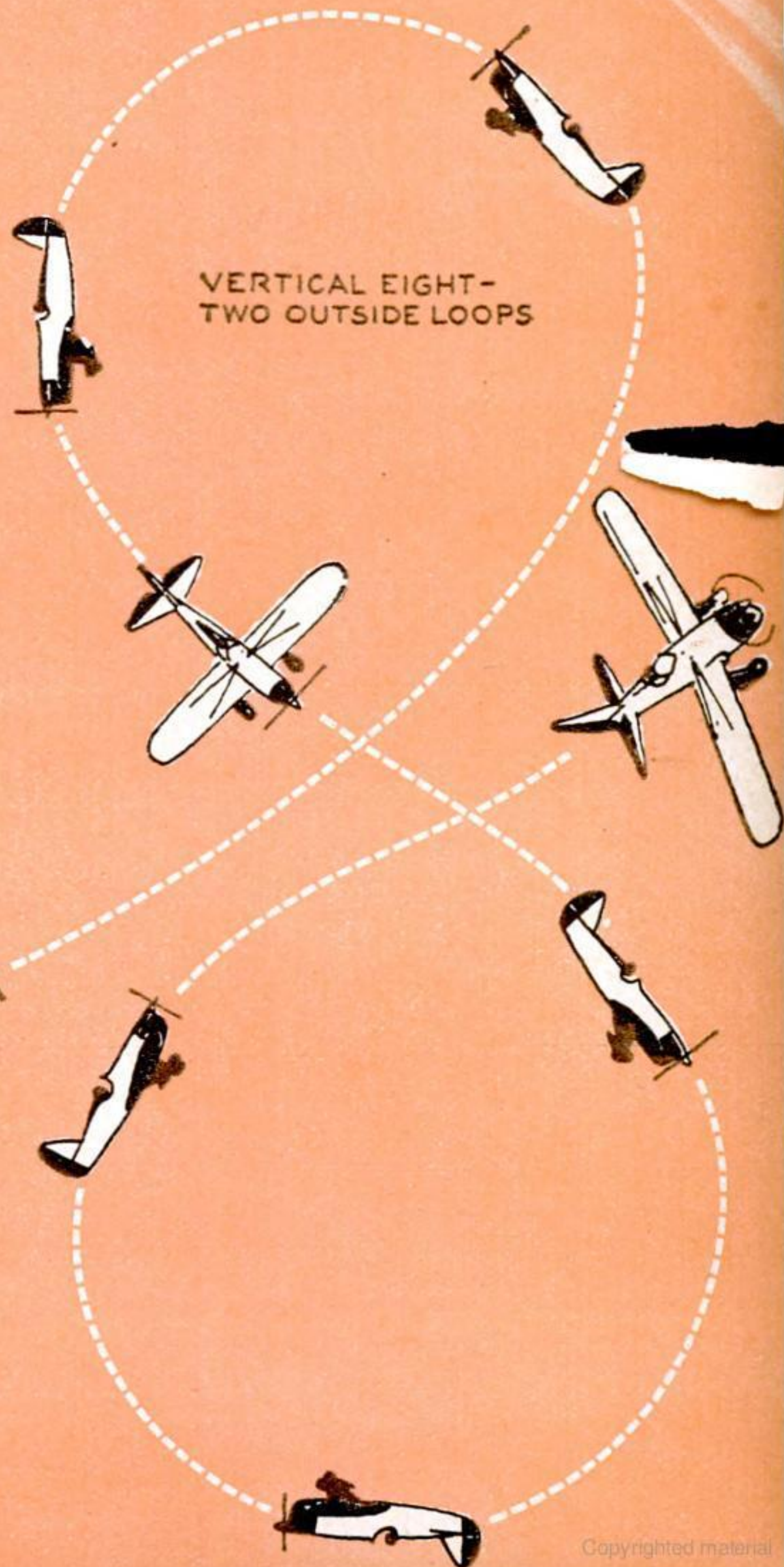
plane, a standard low-wing two-place open cockpit job, equally well with either hand.

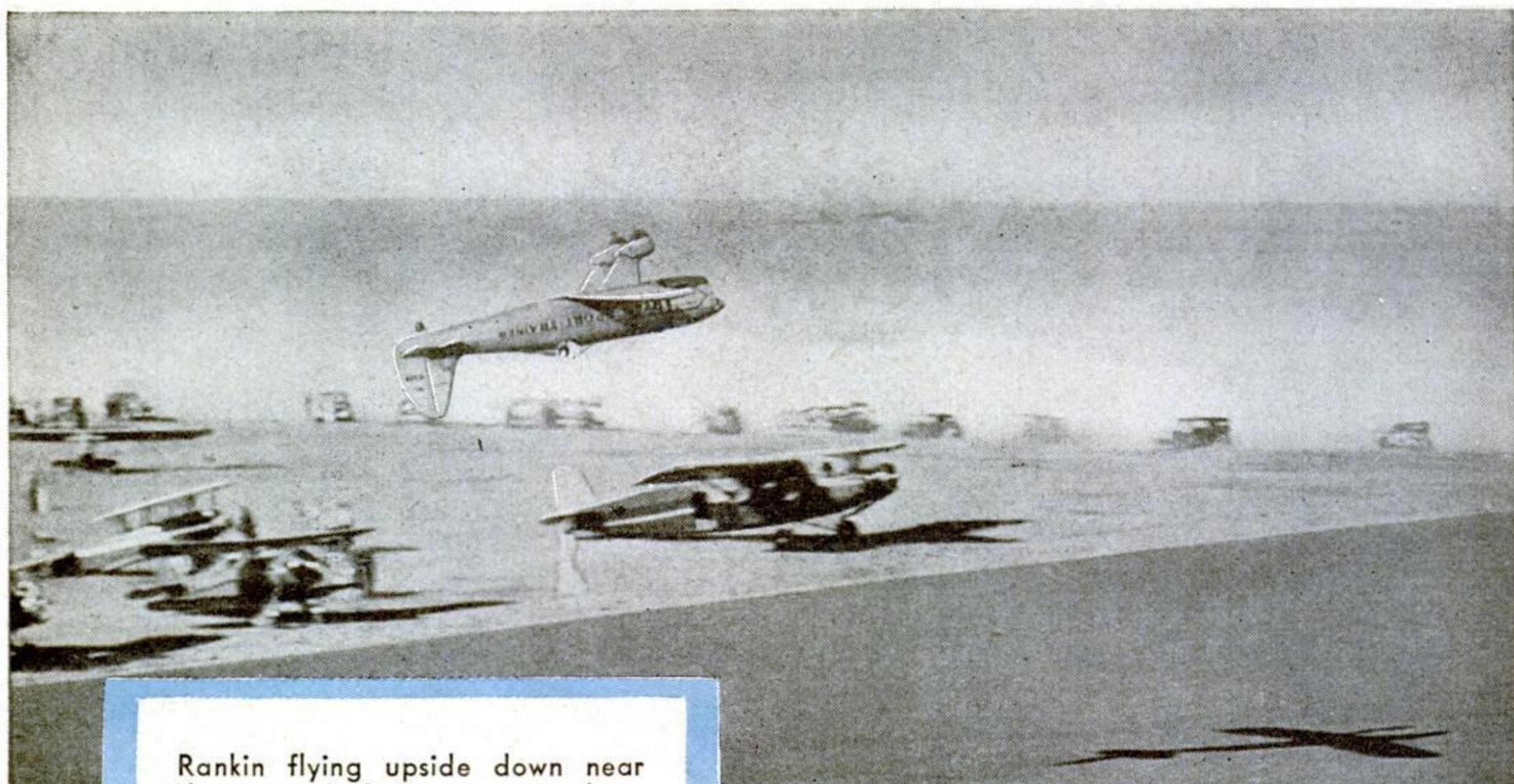
Back and forth across the airport at Augusta, Me., Rankin flashed not long ago, his little plane now tightly banked, again rolling, looping, stalling, spinning, and roaring upside-down the length of the field, scarcely a man's height above the runway. Minutes later, having thrilled the crowd with sixteen different stunts in rapid-fire order, the pilot slipped down to a landing and hopped from the cockpit in front of the stands.

"The guy's been flying with one hand," exclaimed an incredulous onlooker.

It was true. Rankin not only performed at the Maine Aero Show stunting with one hand, the other broken several days earlier in cranking a propeller, but he had flown across the continent from Los Angeles with his wife as passenger. The following week he went on to Cleveland, where he represented the United States on the international stunt team at the National Air Races.

Ever since he was mustered out of the air service, just after the World War, Rankin has been seeking perfection in flying. His first





Rankin flying upside down near the ground during an air show. He reaches a speed of 300 miles an hour while doing this trick

flight carried him aloft in a flying boat of the pusher type with Eddie Hubbard at Seattle, Wash., in 1916. That experience recalled for him the remark of a high-school psychology teacher in Brenham, Tex., where he was brought up. "Every one is afraid of what he does not understand." He admits he was frightened on his first hop, so he then proceeded to learn all he could about the mysteries of flight.

Rankin early became a barnstormer out west. Often he found himself in tight places, and never knew how he had extricated himself. One day the idea struck him that he should try an outside roll while on top of a loop. He pushed the stick ahead and kicked the rudder. Immediately the horizon commenced flying around his head, and pushing on the stick only tightened the upside-down spin, which meant that his head was flying around the outside of the circle.

Suddenly he remembered that a French instructor had told him he could throw any ship into an inside spin by pulling the stick back and kicking the rudder. He yanked back on the stick, shoved the opposite rudder, and in a second the plane was spinning with his head inside the circle. Then he neutralized the controls, and recovered normal flight.

That experience marked Rankin's beginning in the aërobatic game, and illustrates the trial-and-error method by which he prepares for each appearance. Take, for instance, his flight at St. Louis last year, when he beat the best aerial acrobats of two continents.

Before entering his name in the list of entries, Rankin had recorded more than 7,000 flying hours in his log book. He considered himself one of the world's most skilled precision flyers, and he's not given to boasting. But experience and skill were not enough. He wanted to win that contest before it started.

Rankin consulted the rules and studied the value in points of each stunt. He must start his maneuvers with a loop and a slow roll, after which he could shoot the works. From the loop and slow roll, plus vertical banks, snap rolls, and spins, he must draw his tricks, for all maneuvers are variations or combinations of these five fundamentals.

Out in Burbank, Calif., where Rankin hangs his ship, stunt-flies for the movies, and teaches advanced students the art of aërobatics, he began experimenting. From the eighty-four allowable maneuvers, bearing values of one to ten, he selected those awarding highest points. Day after day he practiced, and finally was crowding twenty-five maneuvers into ten minutes, the prescribed time limit.

His first program gave him a theoretical total of 246 points. That, he decided, was not enough. He rearranged his program no less than twenty times, until he evolved a group of maneuvers giving 297 points. When he finally reached St. Louis, he was ready with a series of stunts which packed 282.7 points onto the judges' pads, and Rankin took the international championship with ease.

Precision, always precision. Nothing left to chance. After arranging a program, Rankin pastes it up on his instrument board, and follows those cues to the second. He has

evolved and adapted from other flyers a number of trick maneuvers involving figure 8's and today can perform more eights than he can remember—such as an inside 8 consisting of two inside loops, one above the other. Or an outside 8, in which he starts upside down, does a half roll at intersections, and finishes upside down. This is the reverse of the "Cuban 8" introduced by Capt. Lem Povey, famous Cuban stunt pilot.

When it comes to thrills, Rankin has experienced plenty. Near the end of an exhibition at Miami, Fla., he rolled his plane into a spin. Starting at 2,000 feet, he intended to make four turns and come out at a safe altitude. It happened that only a small amount of gas was left in his tank, and the diminished weight, well forward of the center of gravity, threw too much load on the tail. Once in motion, the tail spun faster and faster around the nose, and not until the flyer pulled down his landing flaps and began throwing gas into the carburetor with his emergency fuel pump was he able to pull the screaming ship out of its spin. When he recovered, he had made seven complete turns, and he flashed across the end of the field with less than 200 feet of air beneath his wings.

The big chill of his career left him trembling with anger following a stunting contest at Walla Walla, Wash. Rankin and Basil Russell, who later smacked into a California hill while flying in heavy fog, were tied for



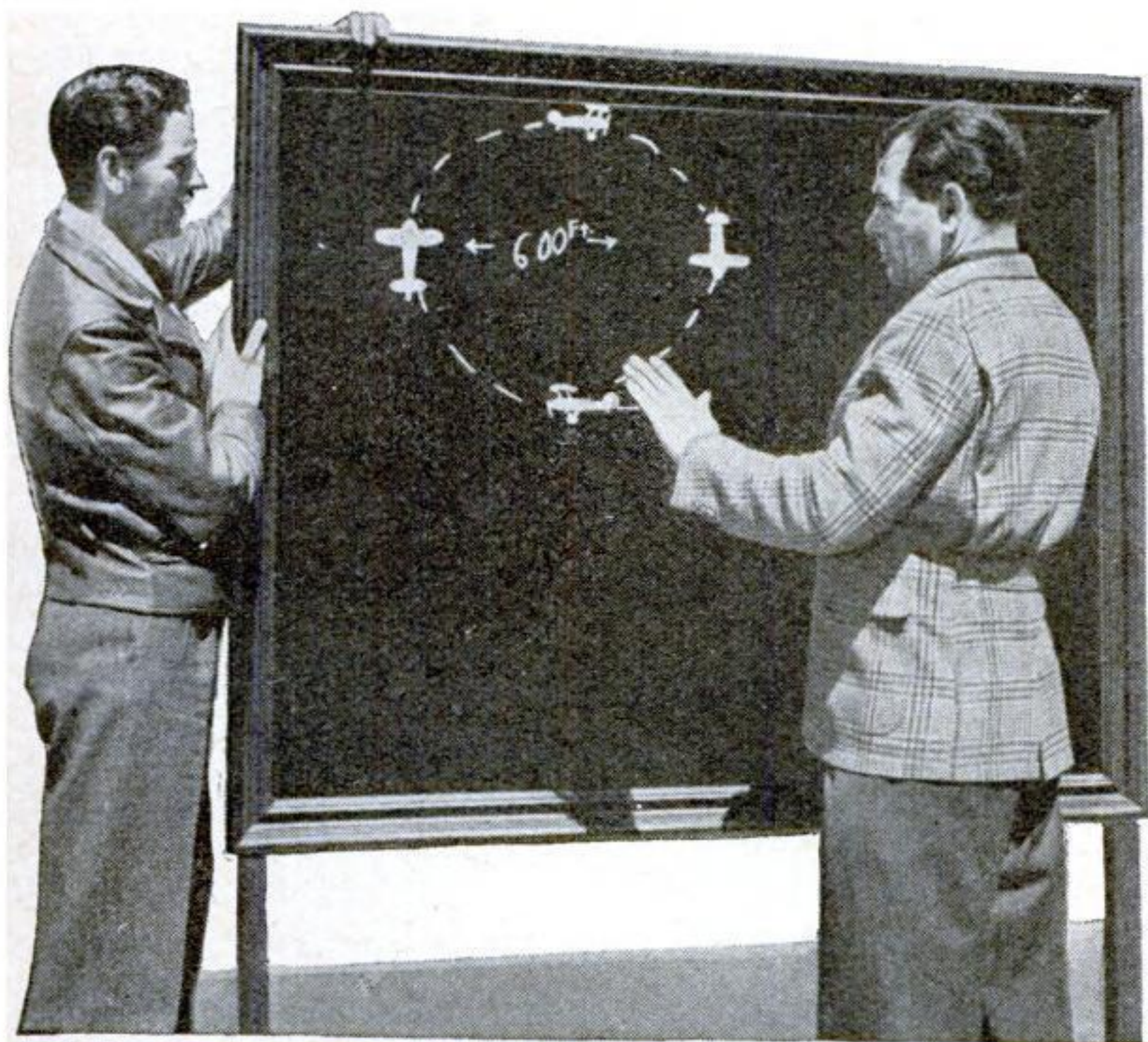
Here he is tuning up his engine before a stunt flight

first place. On his third effort to gain a decision, Rankin dived at the tree-fringed edge of the field and pulled the plane straight up 500 feet, intending to slide sideways back into the field in a vertical side slip.

But he waited a trifle too long, and immediately found himself falling toward the trees in a tail spin! "If I could hit the trees flat," Rankin told me, "I figured I might not be seriously hurt. The motor was running wide open. I recovered from the spin and put the ship into a nose dive straight toward the tree tops. Just as I was about to plunge into the trees I pulled the control stick back sharply in an effort to change the direction. Fortunately the wings had enough lift to change the nose dive to almost horizontal flight. The ship settled to the ground at the edge of the airport, where I turned off the switch after a hard but perfect landing. I sat in the cockpit scolding myself for doing such a silly thing."

While Rankin was congratulating himself on having escaped death, one of the judges ran over, saying, "You win. Russell says he will not try a tail-spin landing."

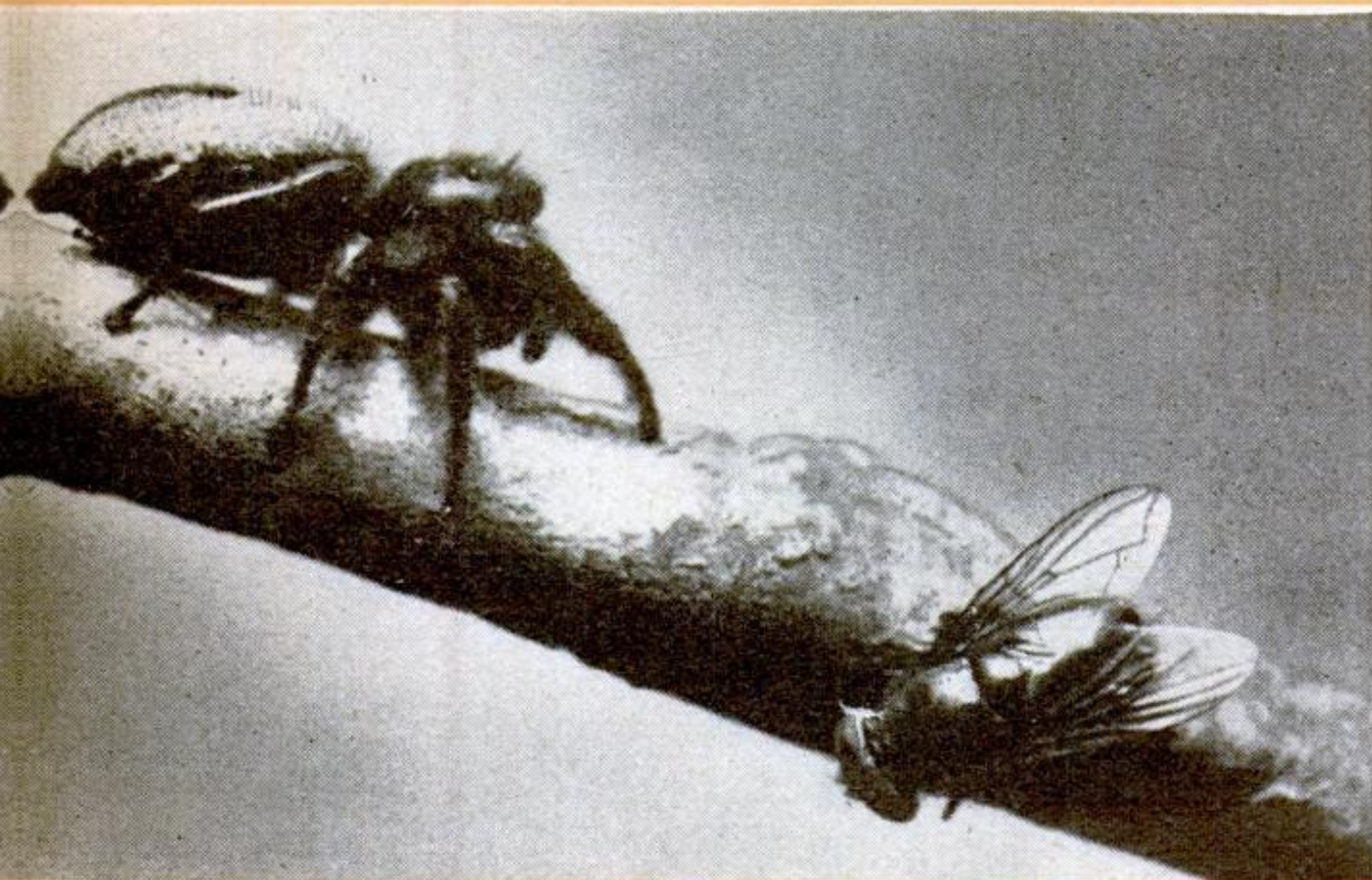
Tex managed a grin. "That was an accident, not a stunt," he explained. On the side lines, a few minutes later, the two pilots split the prize money and tossed a coin (*Continued on page 246*)



Rankin studying a diagram of a maneuver. He plots every trick and works out details before trying it in the air



IN AMBUSH behind a small tree branch, an adult female jumping spider (*Phidippus formosus* Peckhams is the name) is wondering where her next meal is coming from



THE QUARRY, a huge blowfly, alights about ten inches away. Catlike, the spider starts creeping up on her prey, keeping her body as close to the limb as possible. Now . .

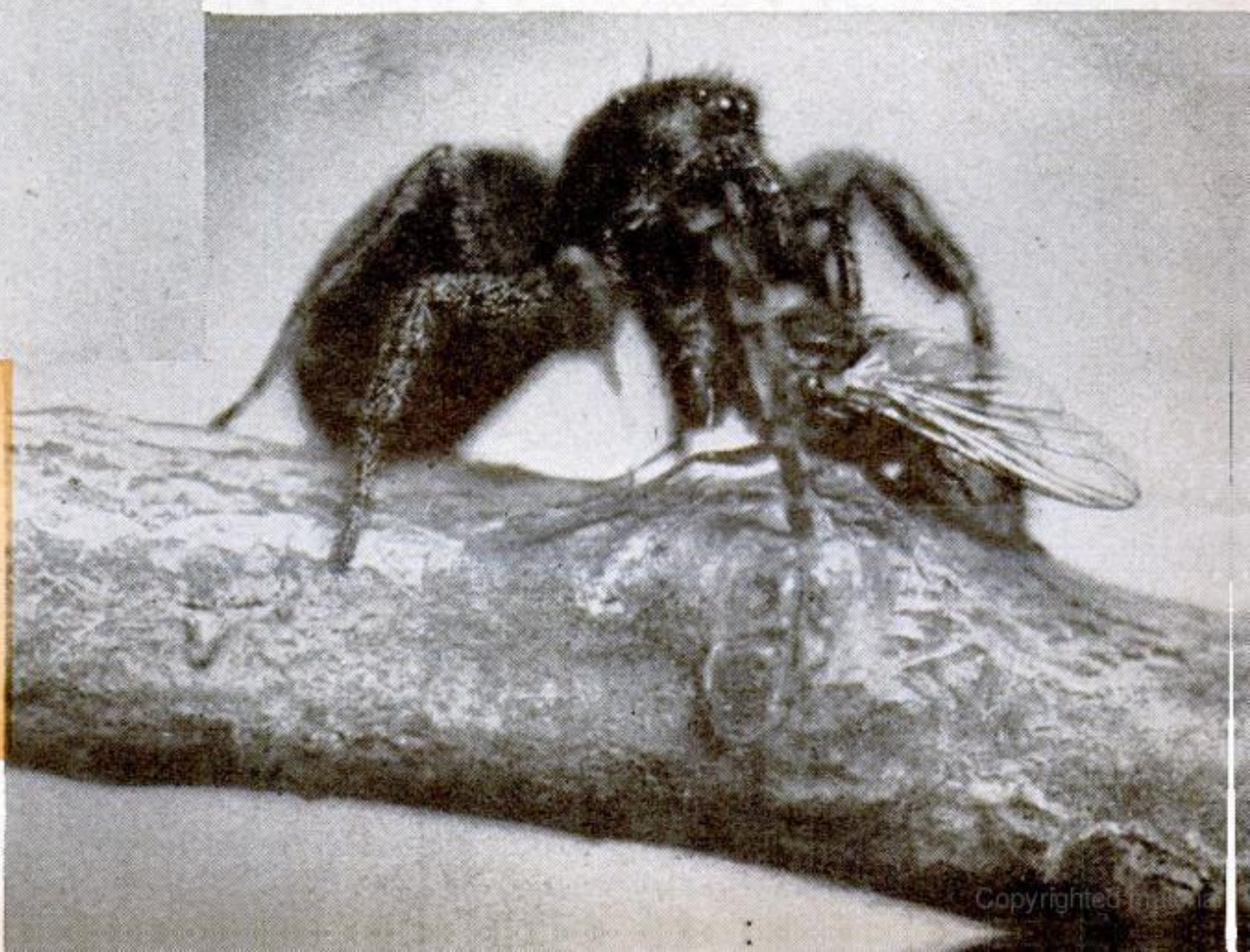


SHE LEAPS! Too fast for the eye to follow, the lightning spring is caught by the camera shutter, showing the exact moment of impact

THE KILL. Within a few seconds the poison-filled fangs have done their work. Most of the bites are aimed at the head



A TIGER would have to cover a quarter of a mile in a single bound to equal, in proportion to its size, the leaping ability of some of the jumping spiders. These strange creatures, instead of spinning webs and waiting for their prey as many other species of spiders do, prowl about, stalking their victims and pouncing upon them like cats. One of these spiders is striped black and white like a Lilliputian zebra. It haunts the sunny side of old barns and walls and leaps out into space to catch insects on the wing. A silklike thread attached to the wall stops it in midair, and it climbs back up this strand to dine on its victim at leisure. Like other spiders, the jumpers do not devour their prey. They merely suck away the vital juices through hollow fangs. In a single gruesome feast of the kind, they sometimes swallow enough fluid to equal one-third their body weight. The remarkable series of pictures on these pages show the successive steps by which one of these eight-legged tigers stalks and captures its prey. The sequence was caught by the camera of Lee Passmore, noted California photographer who has taken more than 20,000 insect pictures. (See P.S.M., Mar. '37, p. 36).

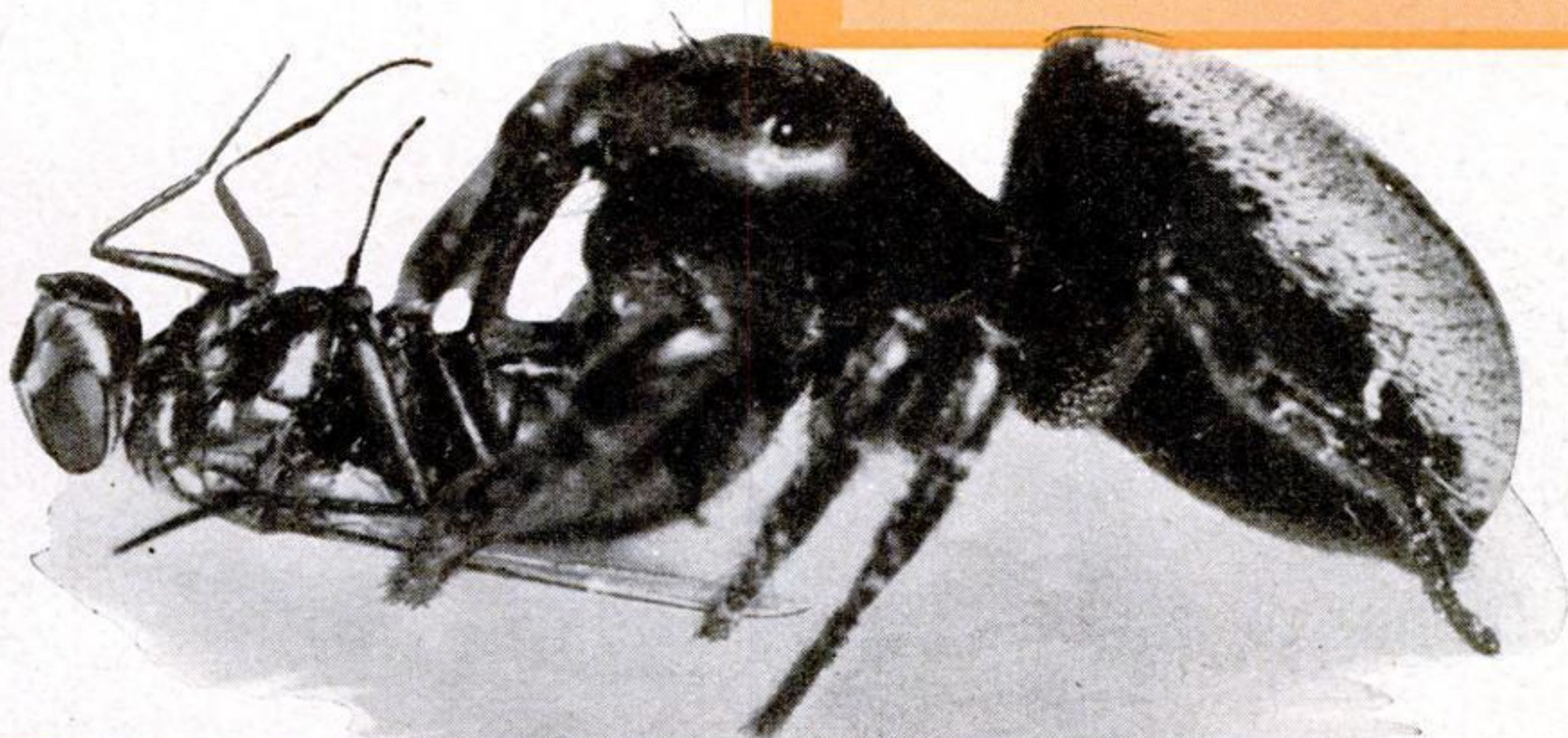


Jumping Spiders

PHOTOS BY LEE PASSMORE



MEALTIME lasts for more than an hour. Sinking her sharp fangs into the lifeless body, the spider turns it over and over until she has sucked out all the vital juices. And . .



WHAT A MEAL! The spider finishes up on the last segment of the abdomen. Notice how her own abdomen is stretched. She can eat about a third of her own weight

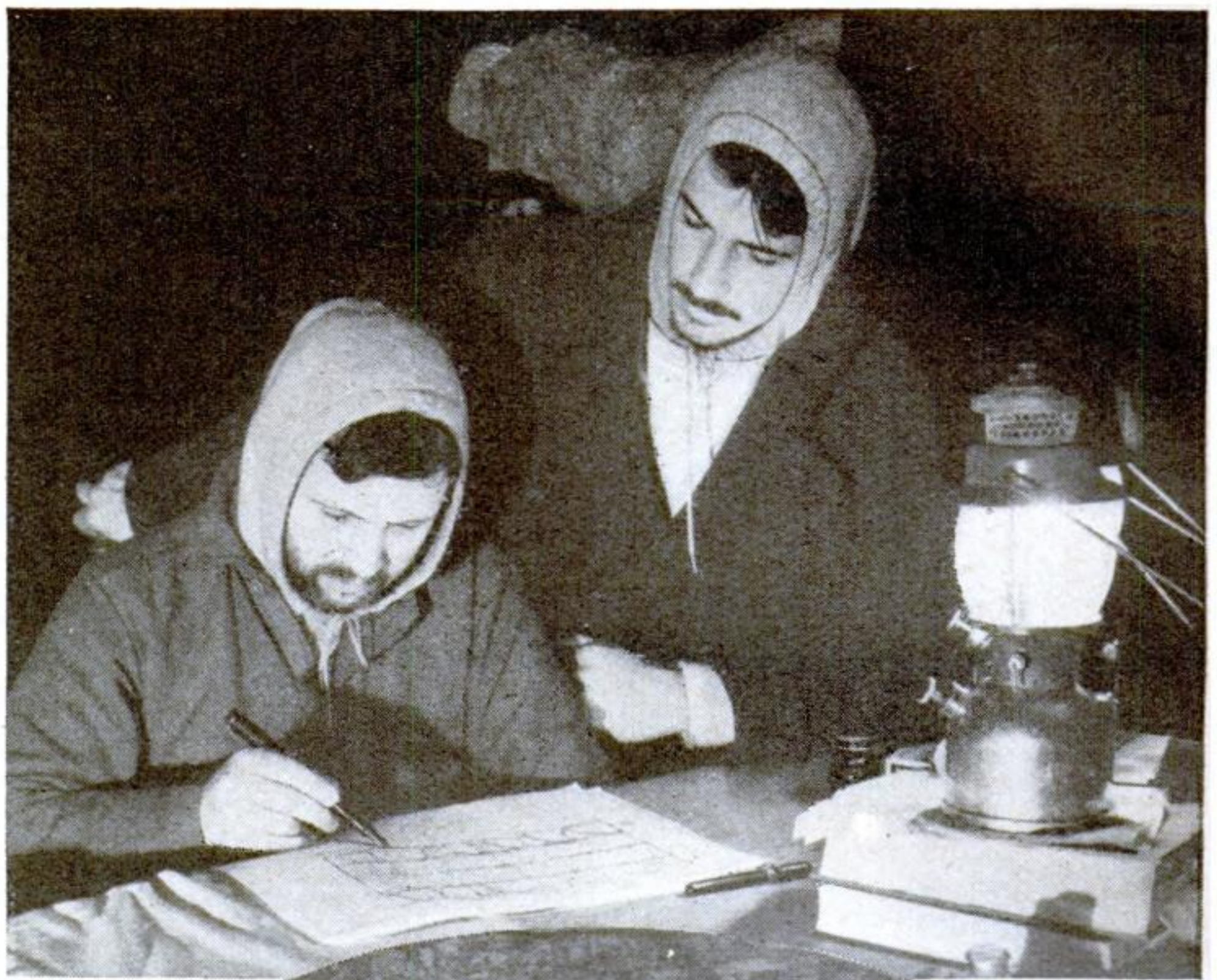


MALE JUMPING SPIDER. And here is *Phidippus clarus* Keyserling, resting at the door of his nest. Notice the size of the two eyes in center

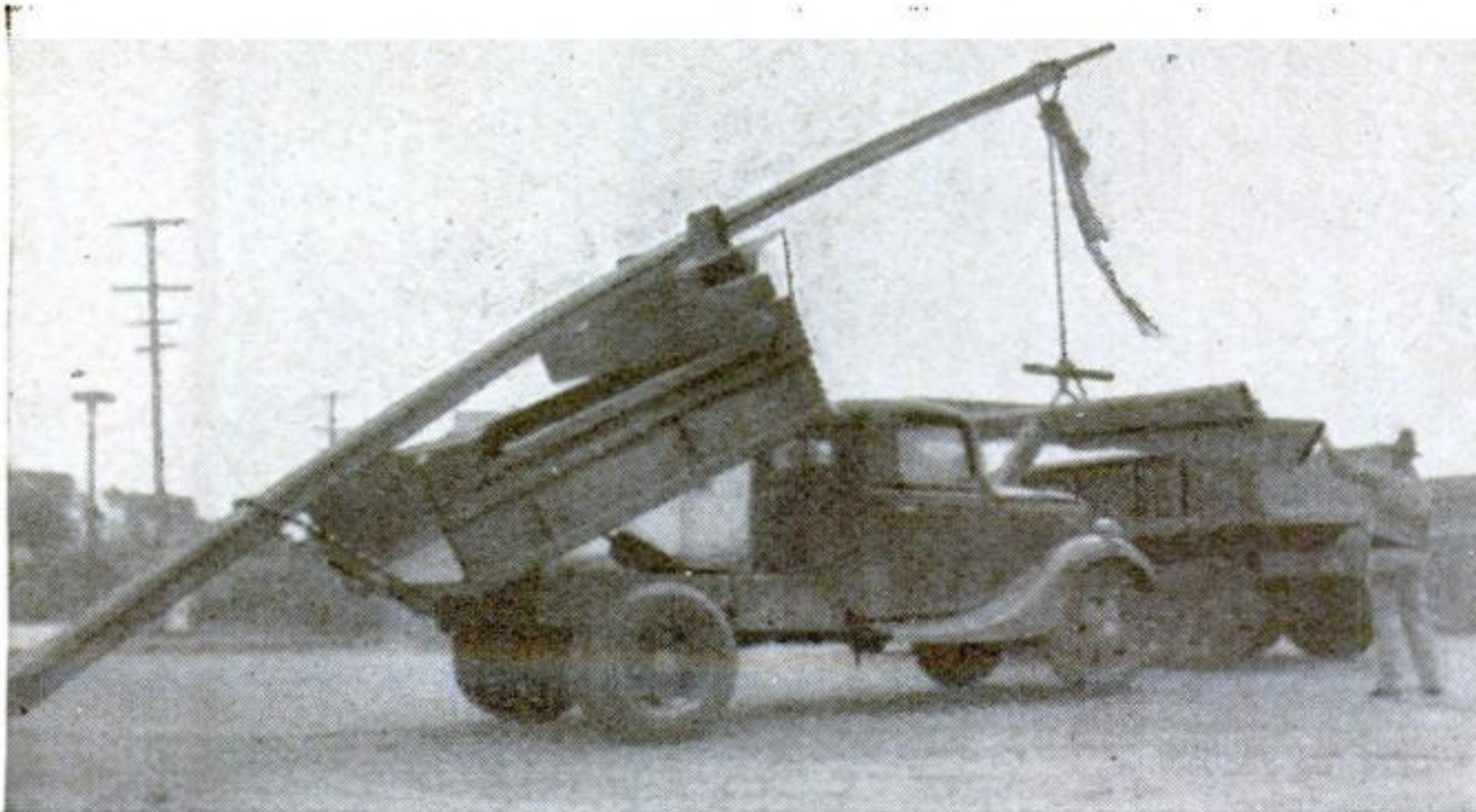
"Cave Men" Live Underground In Novel Test

CAN man change his normal living habits and adjust himself to a twenty-eight instead of a twenty-four hour day? To find out, two University of Chicago scientists, Dr. Nathaniel Kleitman and Bruce Richardson, recently spent more than a month in the interior of Mammoth Cave, Ky., where no changes in temperature, illumination, or sound could affect the experiment, as was the case during a previous test in a Chicago apartment. Warmly dressed to protect themselves from the fifty-four-degree temperature, the scientific cave men kept accurate records and charts of their experiences and reactions. Food and mail were delivered twice daily, but otherwise the scientists had little contact with the outside world. When the experimenters emerged from their thirty-three-day exile, it was said that only Richardson had succeeded in changing his habits to fit a twenty-eight hour schedule.

A home underground. The two scientists and their "apartment" in Mammoth Cave where they attempted to alter their habits of living



Improvised Derrick Made From Large Dump Truck



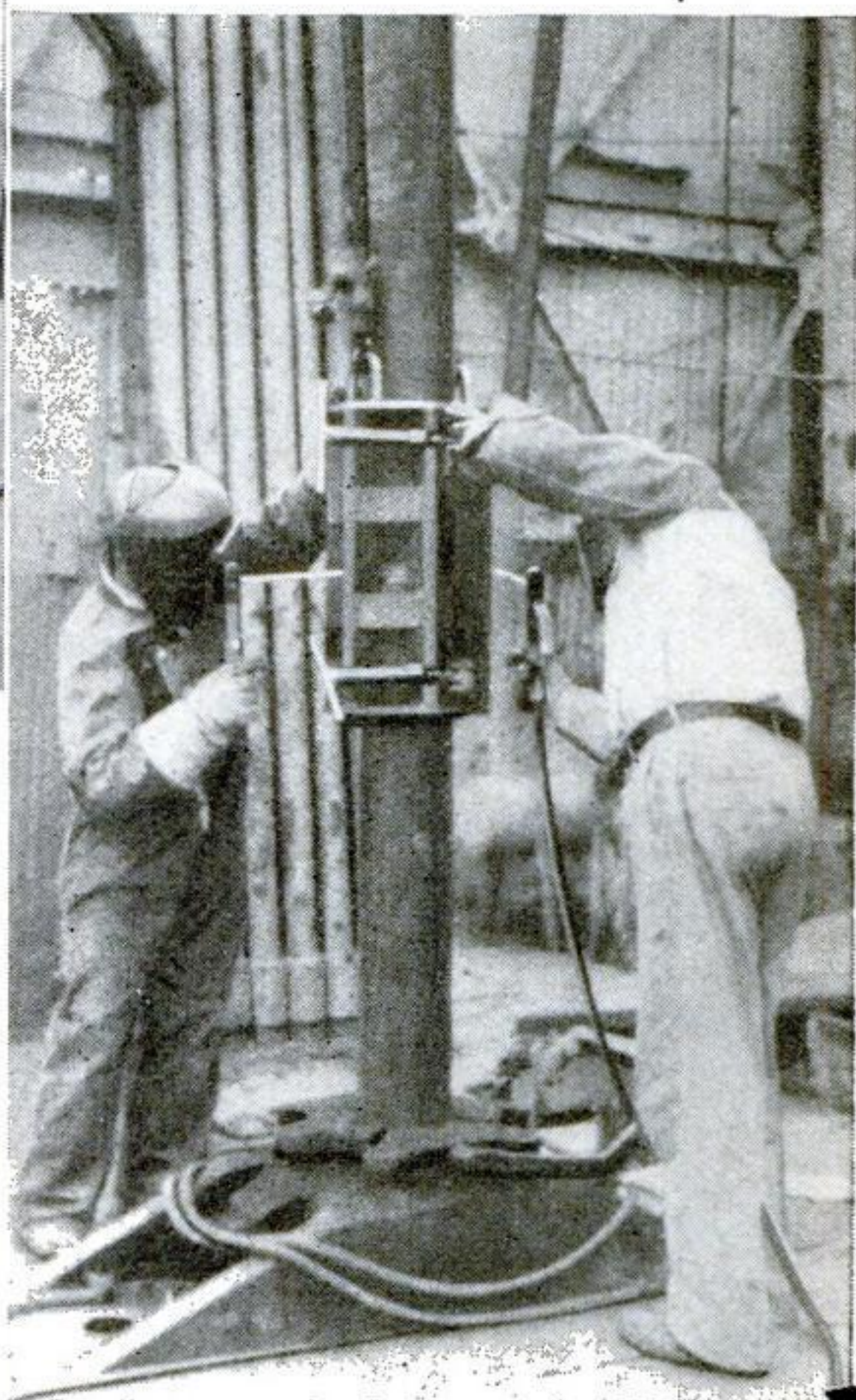
The emergency hoist being used to load heavy timbers on a truck

When they needed a derrick, two California truck operators made their dump truck serve the purpose, as shown at the left. A stout pole having a strong cable attached to one end was mounted on wood blocks laid across the truck body and fastened rigidly with chains. When the truck body was raised or lowered by the motor, heavy loads at the end of the wire cable were easily raised, and transferred from one spot to another by driving the truck.

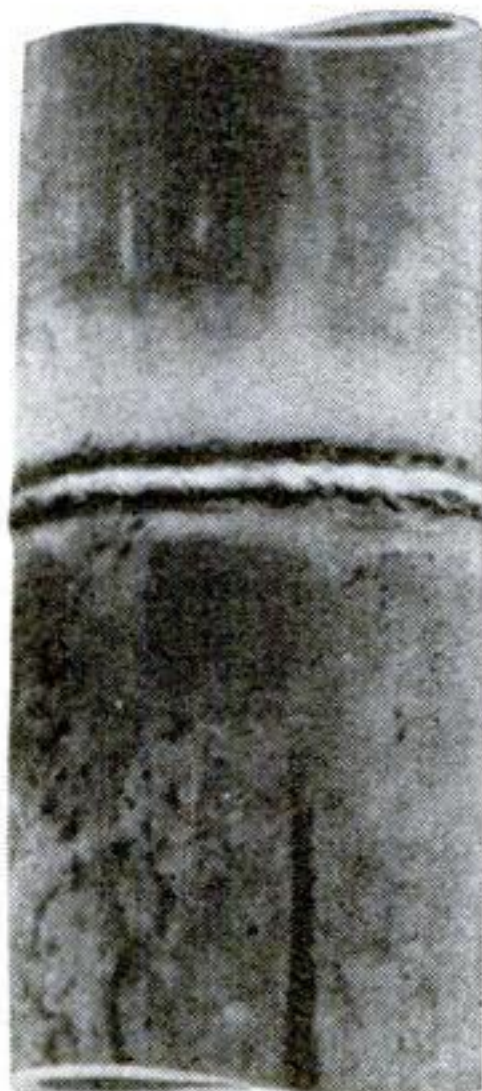
8,000-Foot Oil-Well Casing Is Welded



At left, a welder is sealing the joint between two sections of the 8,100-foot oil-well casing. Below, a close-up showing the clamp holding the pipe in place for welding



WHAT is said to be the longest stretch of welded well casing ever used was recently set in place at an oil well in Carter County, Okla. Making use of modern arc-welding apparatus to seal the joints between separate sections of well casing, experts pushed the pipe down to a depth of 8,100 feet. In a test after the job was completed, air pressure within the casing was built up to 1,200 pounds to the square inch. When no diminishing of pressure occurred within forty-five minutes, experts pronounced all welds perfect along the entire length of the 8,100-foot casing.



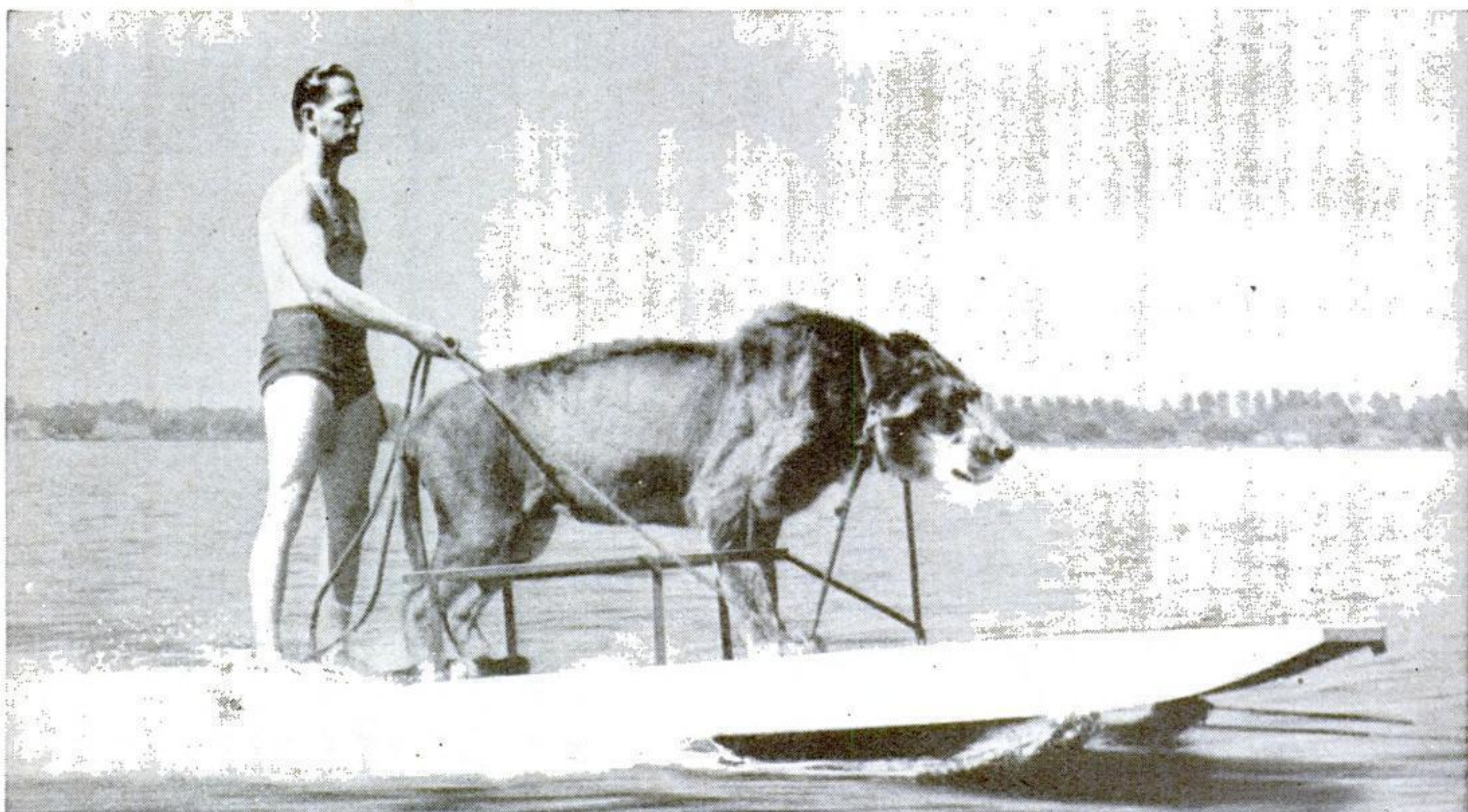
One of the finished welds is seen at the left. Note its neat appearance

Firemen Enter Smoke Box in Queer Race

REPRESENTATIVES of 1,000 fire brigades from all parts of Great Britain recently took part in a national competition demonstrating modern fire-fighting technique at Guildford, Surrey. In an obstacle race, firemen were required to dash across an open field to a shoulder-high chamber filled with dense smoke, don a gas mask, duck into the fumes, and remain there for a full minute before proceeding to the next obstacle.



A British fireman sticking his head into the smoke box in an obstacle race



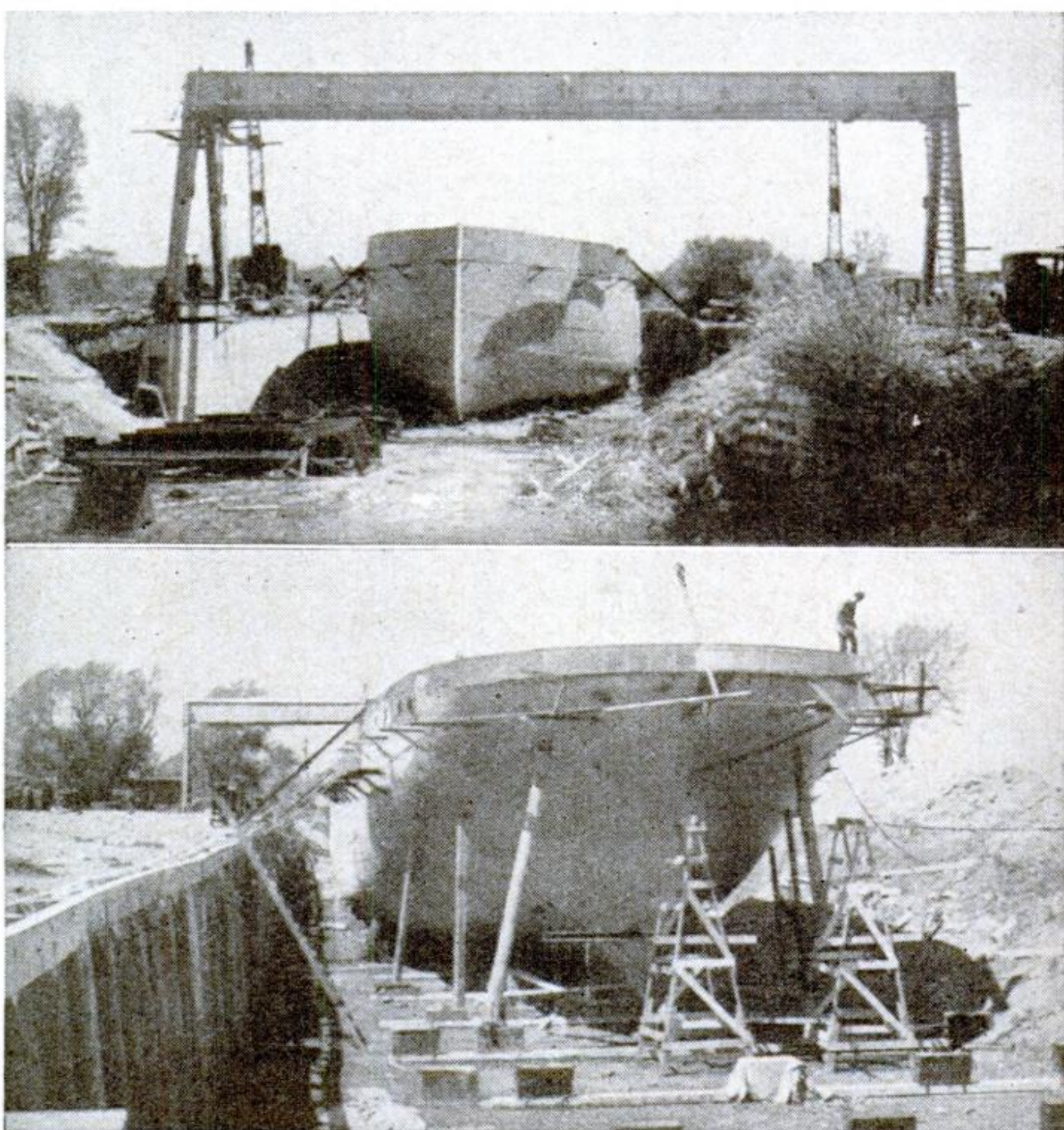
Lion Rides Aquaplane In Daring Water Stunt

TEACHING a full-grown lion to ride an aquaplane behind a speeding motor boat is the accomplishment of Paul Lowman, Warsaw, Ill., animal trainer. Because Leo hates getting

wet, he is careful to maintain his balance on the board. Ropes attached to the animal's neck signal him to get up or lie down when the aquaplane starts or stops.

Old Canal Serves as Dry Dock for Building Ships

SEAGOING freight ships are now being built in an abandoned section of the New York State Barge Canal near Rochester. Heavy engine machinery, steel beams, and hull plates are hoisted into place by a giant gantry crane that spans the odd canal-shipyard. When a vessel is ready for launching, water is diverted into the canal bed and the ship is floated, to be finally towed into the main canal and on into deep water in Lake Ontario. After the usual fitting-out process, the ship is ready for service. A seagoing oil tanker, 297 feet long and having an oil capacity of 1,000,000 gallons, was one of the larger-size ships to be completed recently and launched from the inland canal shipyard.



Bow and stern views of an ocean-going ship being put together in an abandoned part of the New York State Barge Canal, near Rochester

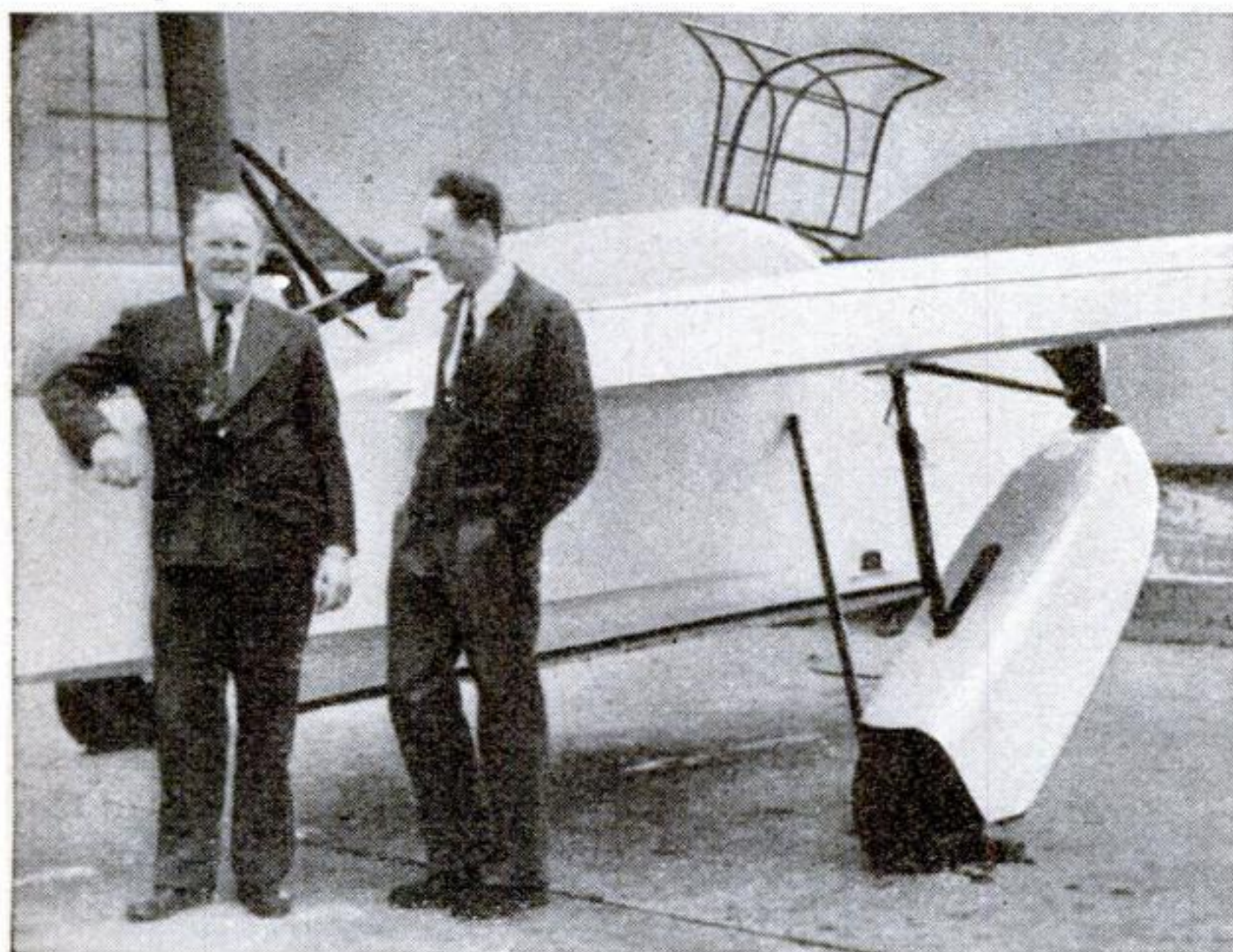
New Fire-Fighting Bomb Blasts Out Flames

BLASTING out flames by means of a sudden explosion is the purpose of a fire-fighting bomb recently devised by an Italian inventor and demonstrated before government officials in England. Made of papier-mâché, the bomb is filled with a special powder. Thrown on the flames, the bomb explodes, giving off a violent puff of inert gases that literally blows out the surrounding flames. The fire-extinguishing weapon, when left as an emergency protection in buildings, will explode whenever the temperature reaches 200 degrees centigrade. It is pictured in a recent test, at the right.



Tossed into the bonfire, the bomb explodes, quickly extinguishing the flames

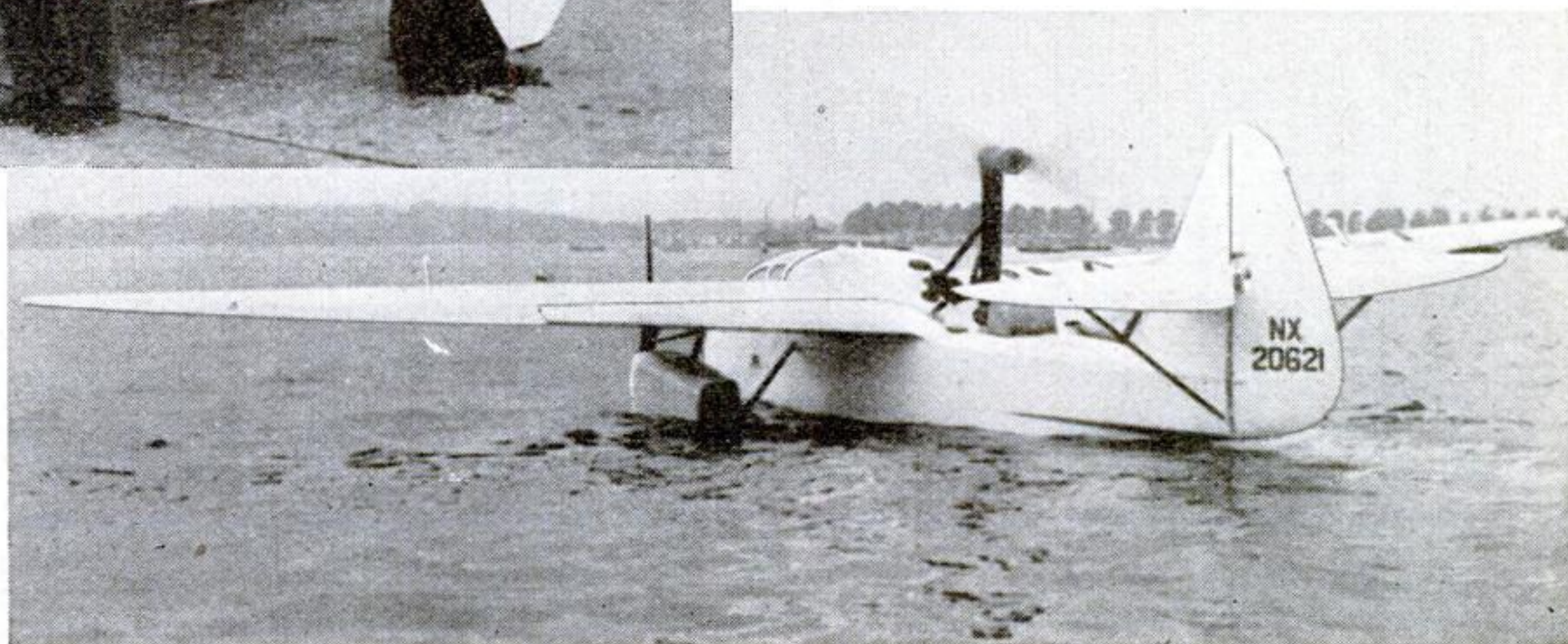
Amphibian's Wheels Mounted in Hinged Pontoons



Landing wheels of the amphibian are set in its hinged outboard pontoons

Right, taxiing on water with pontoons level. Note pusher propeller

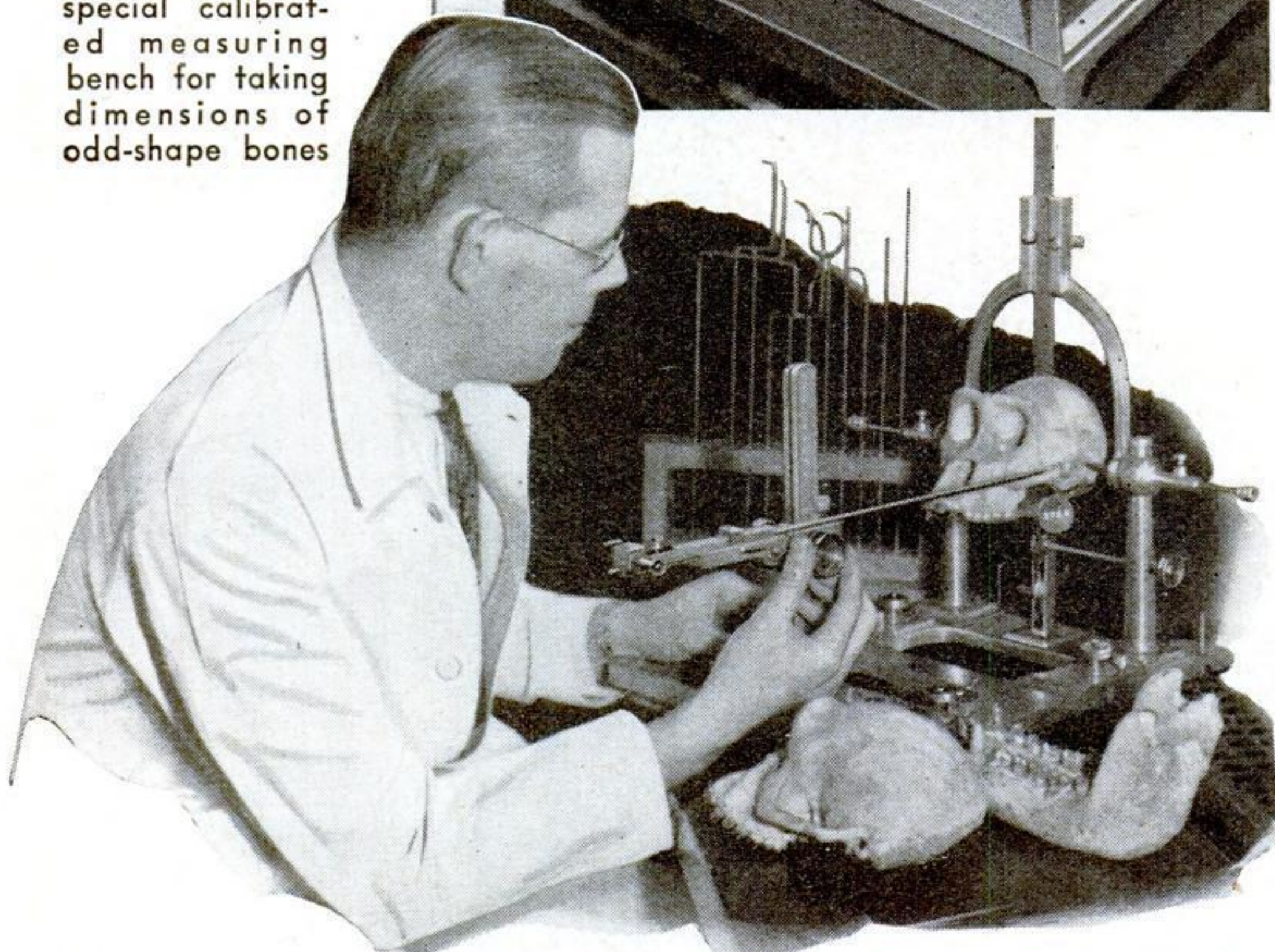
HAVING side wheels set in hinged outboard pontoons that can be swung down at will for landing on the ground, a new amphibian plane recently tested employs a tricycle-type landing gear whose third wheel is retractable into the bow of the hull. The pusher propeller of the sport plane is driven through gears and shafting by a 125-horsepower engine mounted within the hull to cut down air resistance, giving the plane a top speed of 125 miles an hour. The amphibian's low center of gravity insures stability in the water.



History in Bones



SCIENTIFIC BONE YARD. Some of the skulls in Western Reserve's almost priceless collection of 300 ape skeletons. Right, special calibrated measuring bench for taking dimensions of odd-shape bones



Measuring an ape skull with the "craniostat," developed in the museum shop

MORE than 3,500 skeletons, housed in a curious bone laboratory in the medical building of Western Reserve University, Cleveland, Ohio, are aiding scientists to probe for hidden secrets of human history by intensive examinations of the bone structure of man and his nearest animal relative, the ape.

Stored in wooden boxes and steel bins, this valuable research collection includes 3,200 human skeletons and more than 300 ape skeletons—approximately one fourth of all the known anthropoid material in the world. Sci-

entists from all corners of the globe go to Cleveland to study the collection, since its completeness enables them to pursue problems of research that would be impossible to work out anywhere else in the world.

Gorilla, chimpanzee, and orang-utan skeletons are deposited in one section of the Cleveland catacombs, skulls being arranged in rows on wall shelves, and other bones stored in labeled boxes. What makes this anthropoid collection so important to science is not only the large number of specimens on hand but also the fact that the exact native habitat of the animal from which each specimen came is definitely known.

Most of the ape skeletons are obtained from African natives through the coöperation of Dr. W. S. Lehman, a medical missionary in the French Cameroons. Only the skeletons are

New Facts About Disease and Evolution Are Being Learned From a Unique Collection of Skeletons

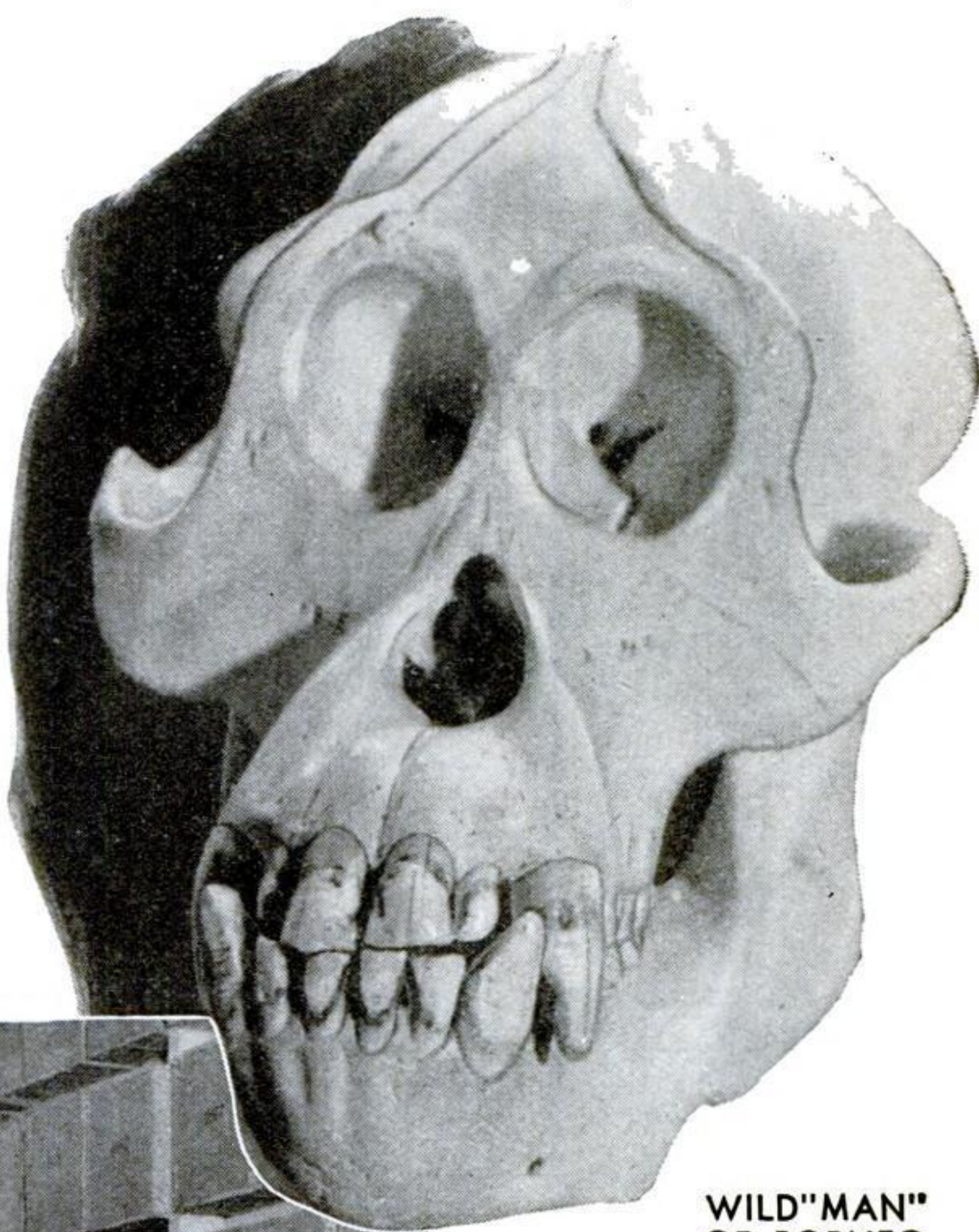
By **WALTER E. BURTON**

shipped to this country, the flesh being removed by the natives through the simple process of placing the body of an ape near an ant hill, and returning shortly to pick up bones eaten clean by the voracious insects.

In another section of the bone museum rest the skeletons of more than 3,000 former Clevelanders. Many of these belonged to persons whose bodies were never claimed for burial by relatives or friends. Others are those of persons who willed their bodies to the museum as contributions to the cause of science. The museum possesses complete case histories of most of these individuals, showing not only their size, weight, and other physical characteristics, but also a full record of the diseases they suffered at various ages.

Most of the research work carried on at the Western Reserve bone laboratory follows three general lines: First, a study of human and anthropoid bones to reveal the manner in which the proportions and size of bony framework change with age, for, scientists point out, bones grow at varying rates. The head of a human being, for example, attains its full size long before the legs develop to their final length.

A second major field of study concerns the racial and sexual differences in skeletons, while a third deals with the effects of disease on bone development. In this third field, a scientist may wish to examine the possible imprint of chronic physical disorders on human skeletons. The bone boxes at Cleveland will afford him examples at every desired age



WILD "MAN" OF BORNEO

Specimens like this perfect skull of a Borneo orang-utan provide valuable data on evolution



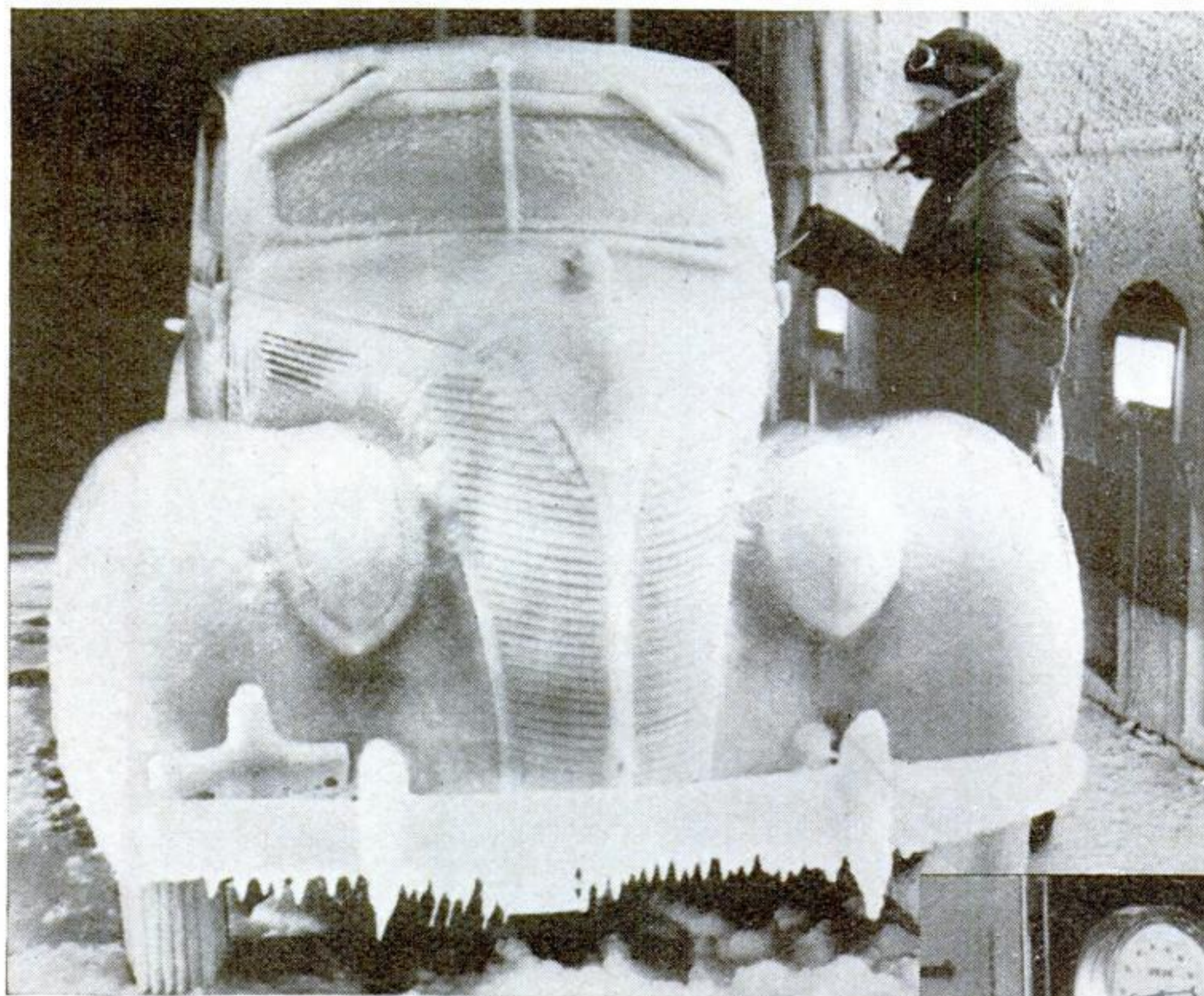
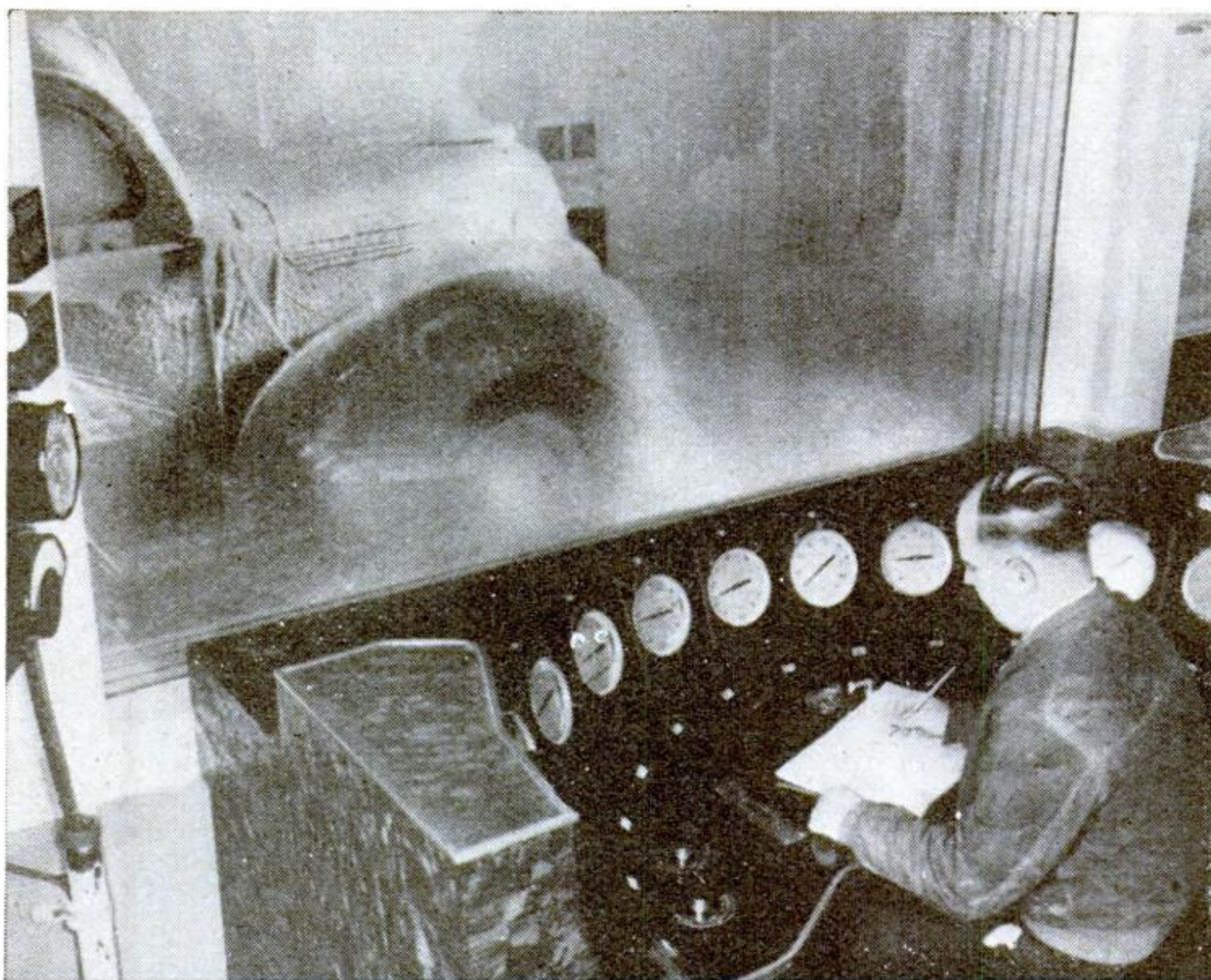
BONE VAULT. More than 3,500 complete skeletons, one to each bin, are stored as above. Each skeleton's history is on file

level, representing the condition of the bone structure one day or one decade after the first appearance of the disease. Thus the skeletons of the dead are helping to make conditions better for the living.

Just down the corridor of the museum from the storage and experimental rooms is a completely equipped machine shop where special measuring instruments designed at Western Reserve are constructed for use in making accu-

rate studies of the size and proportions of skeletons, skulls, and individual bones.

Larger collections of human bones are in existence, but none can boast of having the detailed case histories of those in Cleveland's anatomical catacombs. Dr. T. Wingate Todd, director of the museum, says it is the largest collection of skeletal material of known age, sex, and racial stock in the world.

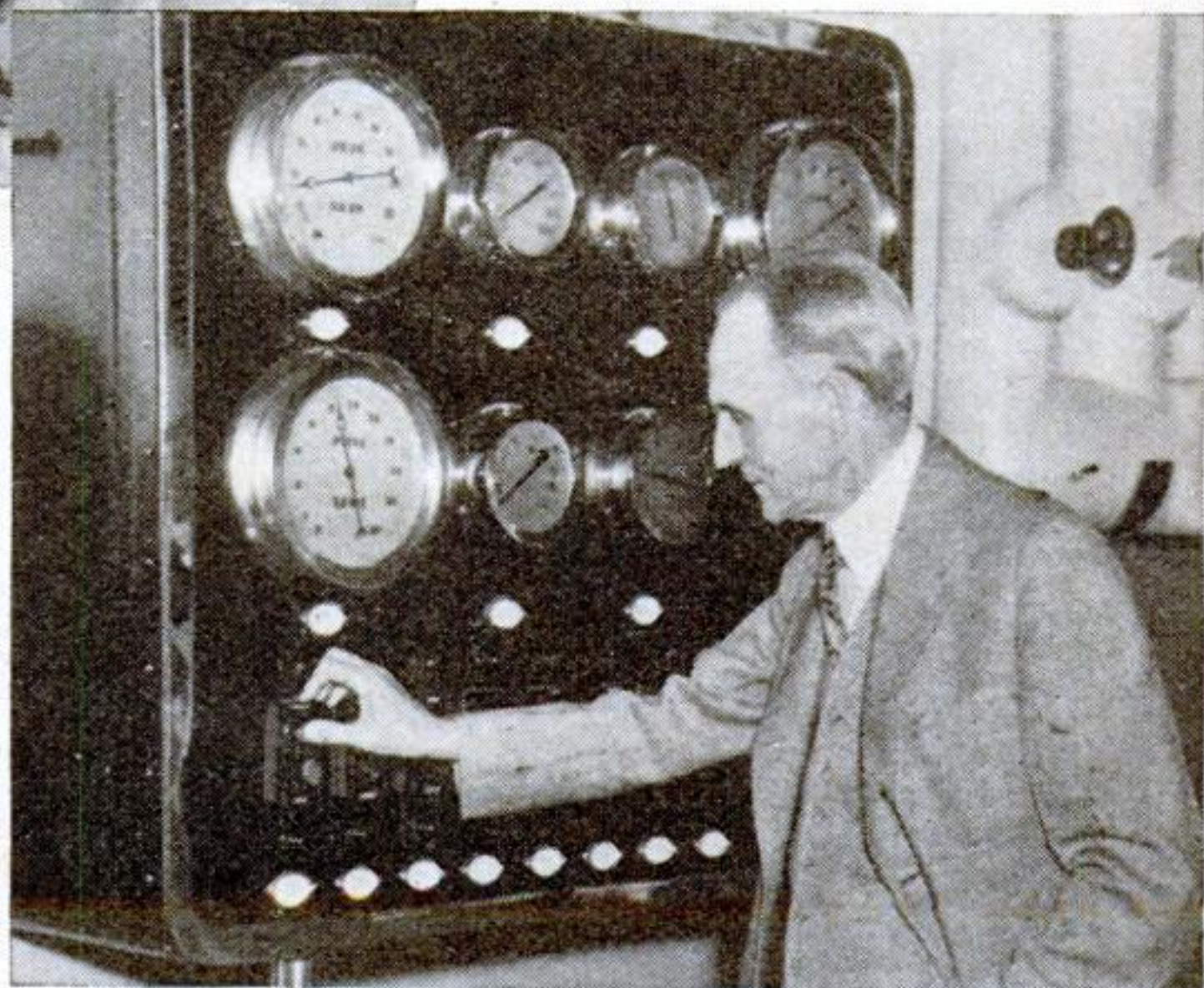


Top, an operator watches the dials as the weather tunnel tests a car's operation in a freezing "rain," one of the thousand weather conditions it can duplicate. Lower picture shows ice-caked car after tests

Automobiles Get Indoor Road Test In Weather Tunnel

• •

ANY kind of weather, found at practically any place in the world, at any time of the year, can be reproduced in an amazing weather tunnel recently placed in service at Dearborn, Mich., by Ford engineers to check operating and design efficiencies of automobiles, trucks, and busses. A rectangular structure 124 feet long, enclosing an elliptical chamber ten feet in diameter, is equipped with a treadmill power-measuring device that allows test cars to be operated at varying speeds under artificially produced weather conditions of any conceivable nature. The equipment includes a refrigeration system capable of maintaining a temperature of twenty degrees below zero Fahrenheit, artificial-rain apparatus, sand and dust blowers, and numerous other scientific weather producers. Tunnel walls formed of multiple layers of heavy, steel-framed glass enable engineers to observe cars under test from an outside control station where instruments and gauges register the tunnel's weather conditions, as well as the test car's fuel consumption, engine speed, and countless other details.



Henry Ford adjusts the controls of the unique weather-creating tunnel at his Dearborn, Mich., plant

Wood Flour Is Used for Bread

FLOUR made from ordinary sawdust is being added to regular flour for bread in Germany, where scientists have developed a wood flour possessing nutritive qualities said to be equal to those of potatoes and corn. Experimenters were searching for a new source of supply for animal fodders. When the nutritive value of the sawdust flour was discovered, the substance was added to wheat flour for the making of bread.



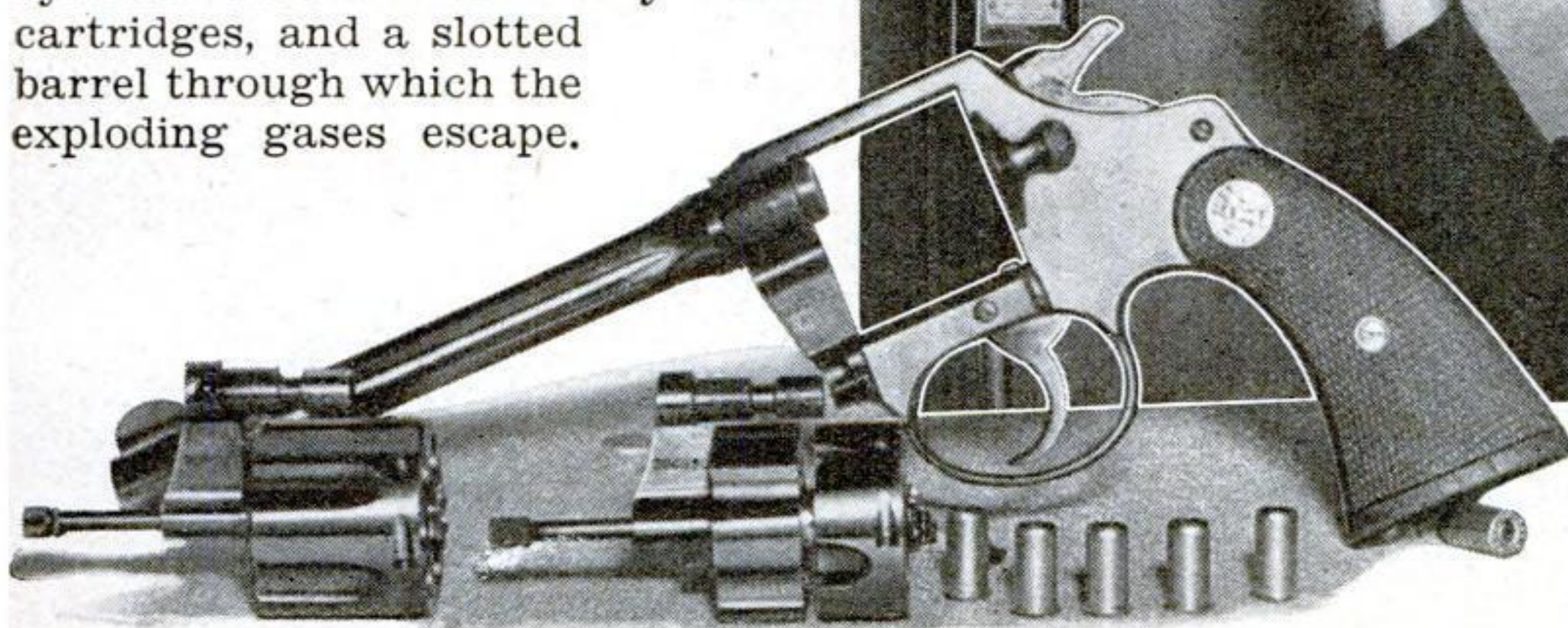
Called "rota," a new bread being sold in German stores, as above, is composed in part of a wood flour



Sawdust being piled in heaps, later to be made into nutritive flour for baking the new German bread

Real Bullets Won't Fit in Foolproof Blank Pistol

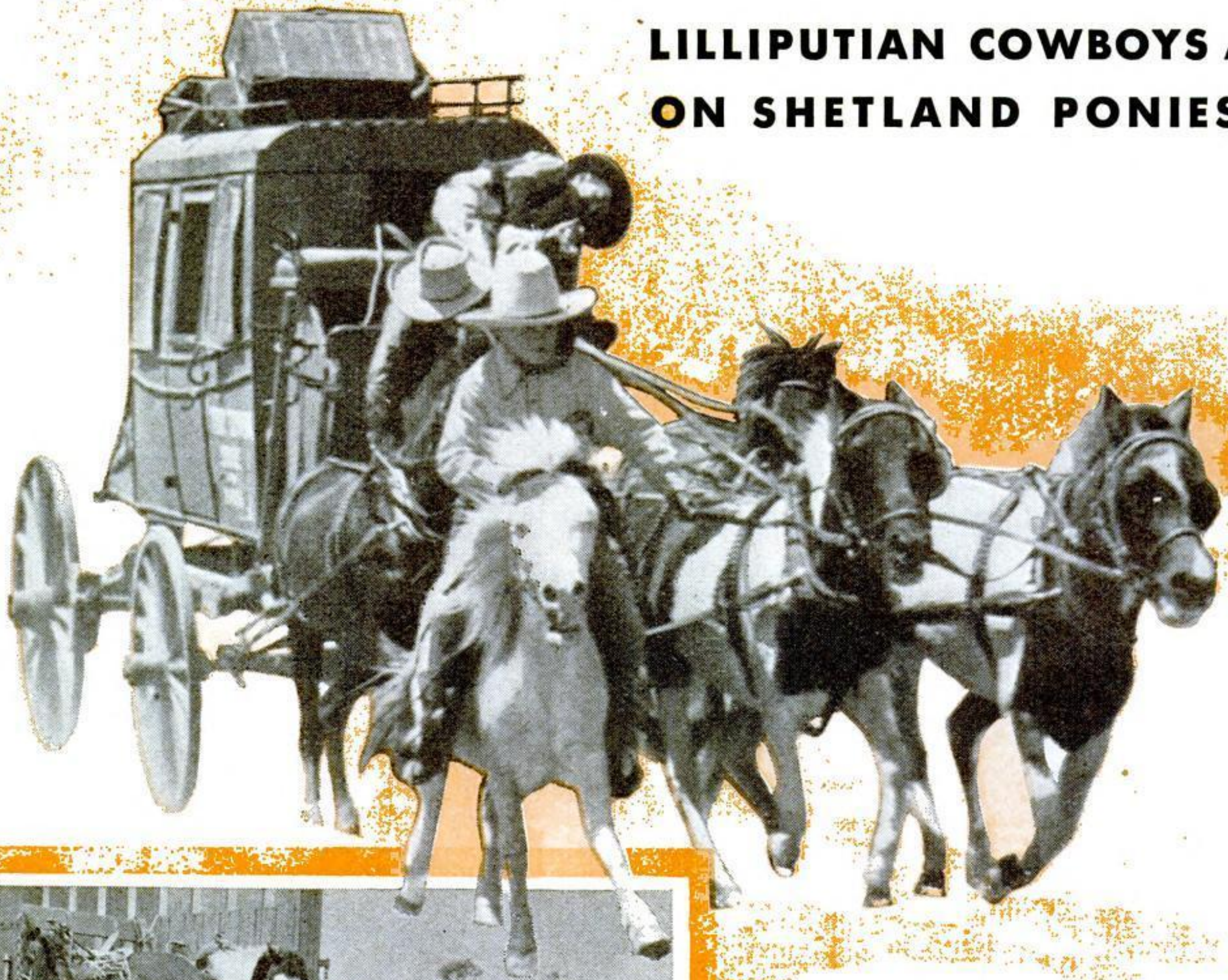
ALTHOUGH it looks and sounds like a real revolver, a gun employed for sound effects in radio broadcasts is completely foolproof. When the safety pistol, which was made by altering a standard revolver, is fired during a broadcast, there is no possible danger to members of the cast, announcers, or the studio audience, since the firearm has a plugged muzzle, a special cylinder that will take only blank cartridges, and a slotted barrel through which the exploding gases escape.



How gas from the blank shot escapes through the slit sides of the pistol barrel. Left, the "weapon's" special parts

Midgets Make

**LILLIPUTIAN COWBOYS AND
ON SHETLAND PONIES IN**



The runaway stagecoach, a standard thrill in western movies, as enacted by Lilliputian cowboys with a miniature vehicle

At the left, Shetland ponies are being unloaded from the van that took them each day "on location" for the midget movie

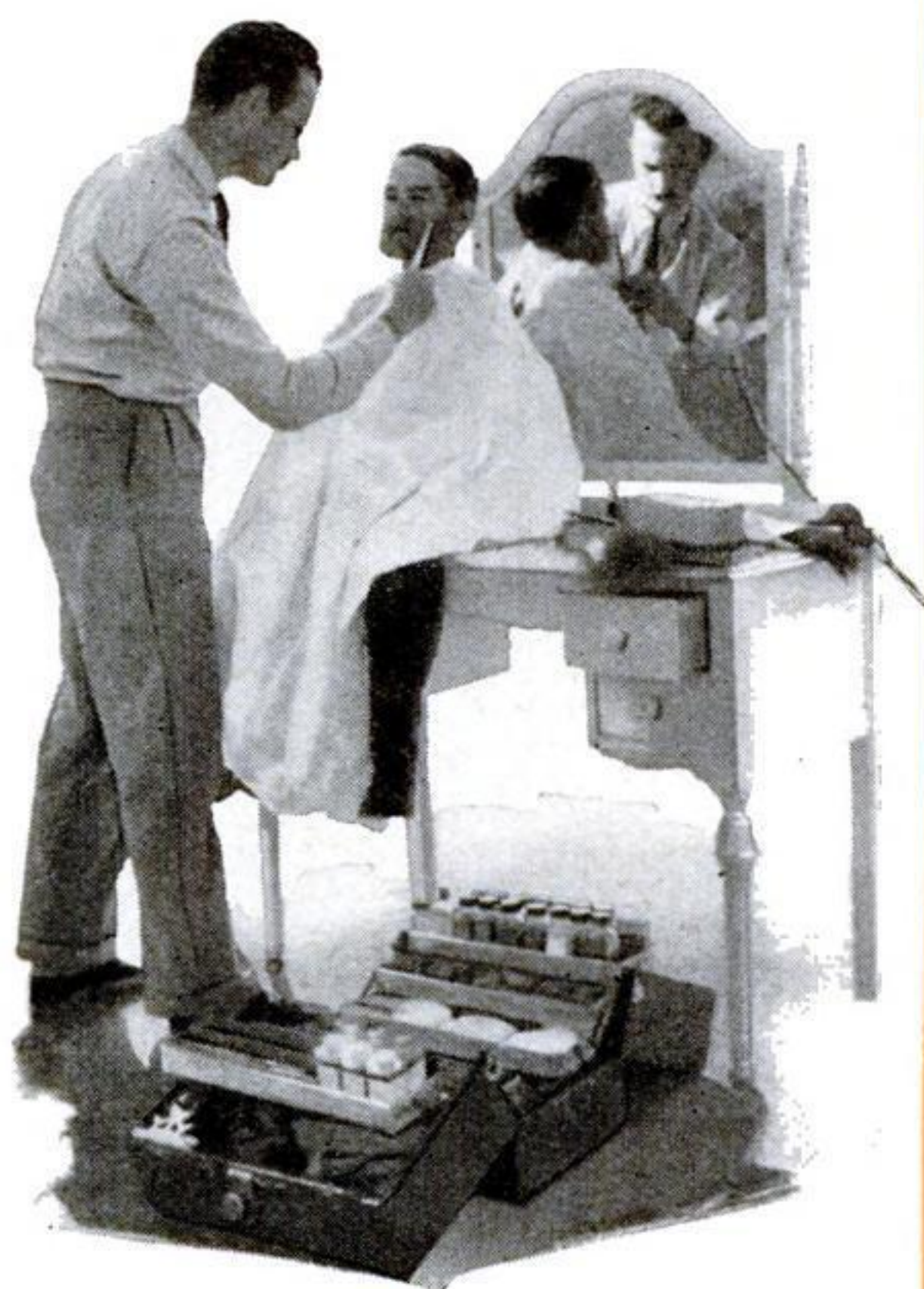
Diminutive actors rode daily from Hollywood to the Lazy A Ranch, forty miles away, in the giant bus pictured below



Miniature Movie

BANDITS SHOOT IT OUT A WESTERN THRILLER

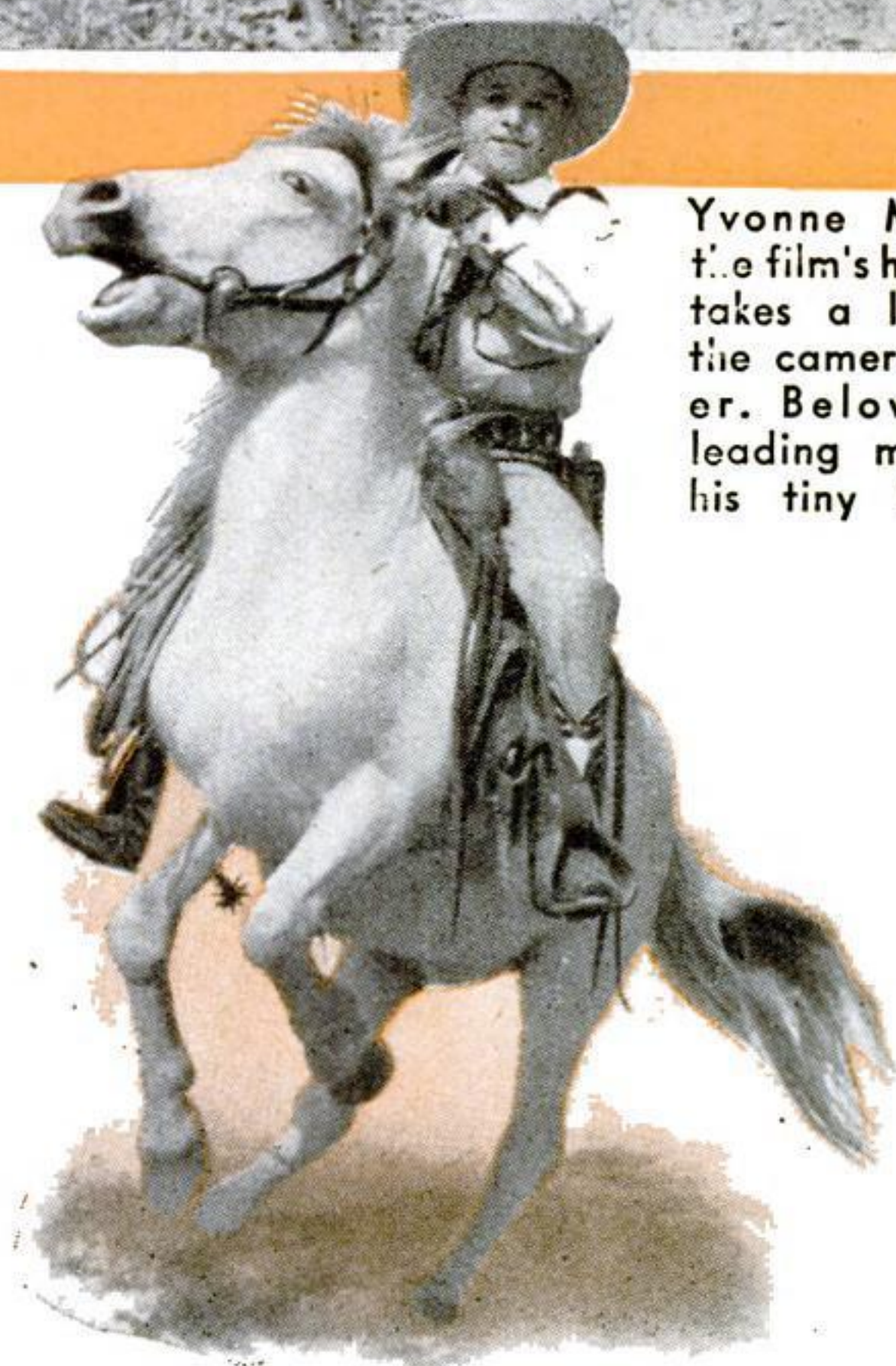
A make-up artist applying a beard to the face of a twenty-two-year-old midget "bad man"



By DAVID M. BENSON

RIDING Shetland ponies instead of full-grown range horses, forty midget actors recently completed the first western movie ever made with these diminutive people. Excepting the ponies and a miniature stagecoach, all the properties were full-size, thus emphasizing the actors' small stature. Reaching Hollywood from circuses and vaudeville acts, the midgets were taught to ride, shoot, handle lariats, and drive a team of four ponies.

None of the midgets used in the picture stands over three feet, ten inches tall, and all are mature. No children or dwarfs were used. Their average weight is sixty-one pounds. Each morning, the troupe rode by bus from Hollywood to the Lazy A Ranch, forty miles distant in the Santa Susana



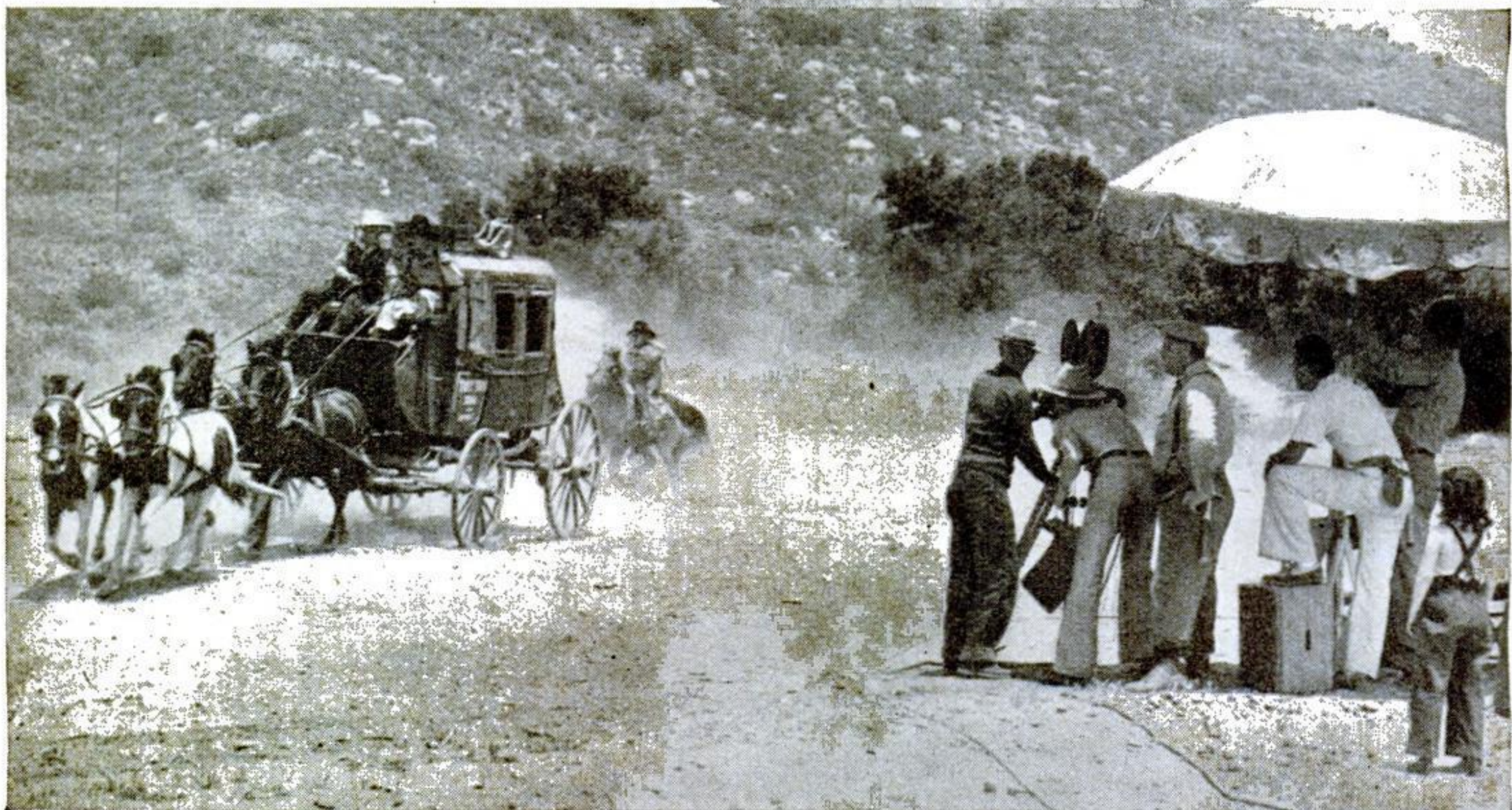
Yvonne Moray, the film's heroine, takes a look in the camera finder. Below, her leading man on his tiny bronco



No western movie would be complete without rope tricks. This tiny cowboy learned to handle a lariat in little time

The lunch-wagon shelf was designed for full-size actors, as the picture at right shows

Bandits attack the mail coach! Below, the camera is catching the scene. The coach is half-size, like riders and horses



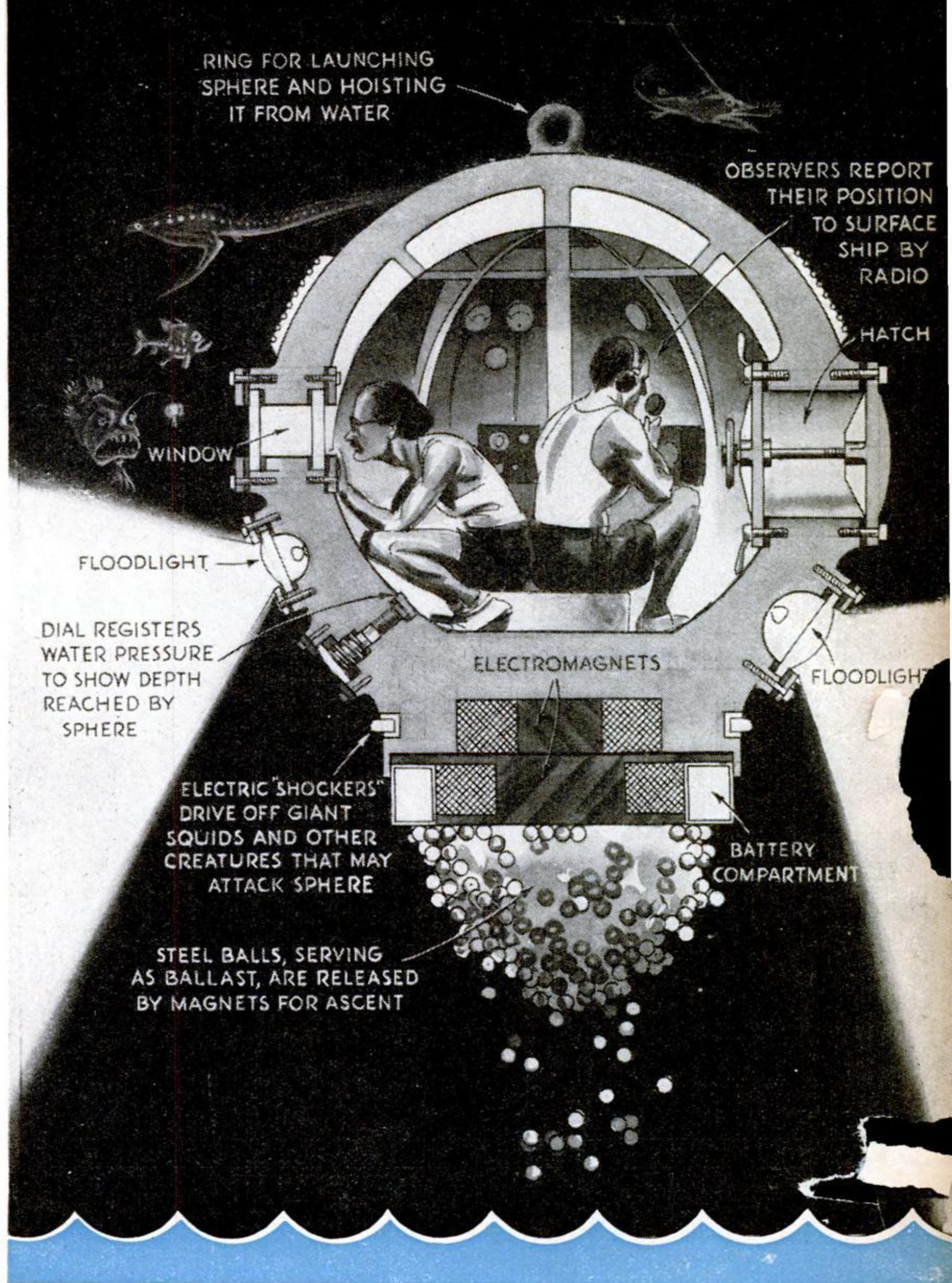
mountains, where outdoor scenes were filmed.

As the hero of the tiny town where the action of the movie took place, Billy Curtis, twenty-nine-year-old Chicago actor, played love scenes with twenty-one-year-old Yvonne Moray, of Brooklyn, N.Y. Many scenes familiar in western films were included, such as calf-roping, the inevitable chase of a runaway coach, and the shoeing of horses by a tiny blacksmith. Among the well-known Lilliputians appearing were Little Billy (his full name), an old-timer in Hollywood; William Platt, a sixty-two-year-old retired performer, and Billy Platt. So tiny are the actors, they could neither reach their food at the ranch lunch stand nor see through the camera's finder without assistance.

NEW Diving Sphere

TO EXPLORE
THE SEA AT
FOUR-MILE
DEPTH

DRIFTING down through the dark waters of the ocean to a depth of nearly four miles, a unique, free-floating diving sphere, unconnected by any cable with the surface, may carry Prof. Auguste Piccard, famous Belgian stratosphere balloonist, to unexplored ocean levels more than six times as deep as the present record of 3,028 feet established in 1934 by William Beebe, American naturalist and explorer. Scheduled for 1939, the record descent will be attempted near the Canary Islands off the northwest coast of Africa. Present plans, it has been revealed, call for an aluminum-alloy sphere, seven feet in diameter and resembling in many respects the balloon gondolas used by the Belgian scientist in his stratosphere flights. To drag the floating globe downward, ballast, in the form of steel balls, will be held onto the bottom of the sphere by electromagnetic coils. From an inside control panel, the underwater explorers can diminish the flow of current through the electromagnets, thereby releasing any desired quantity of the ballast to allow the sphere to rise to a higher observation level or to the surface. It also will be fitted with a

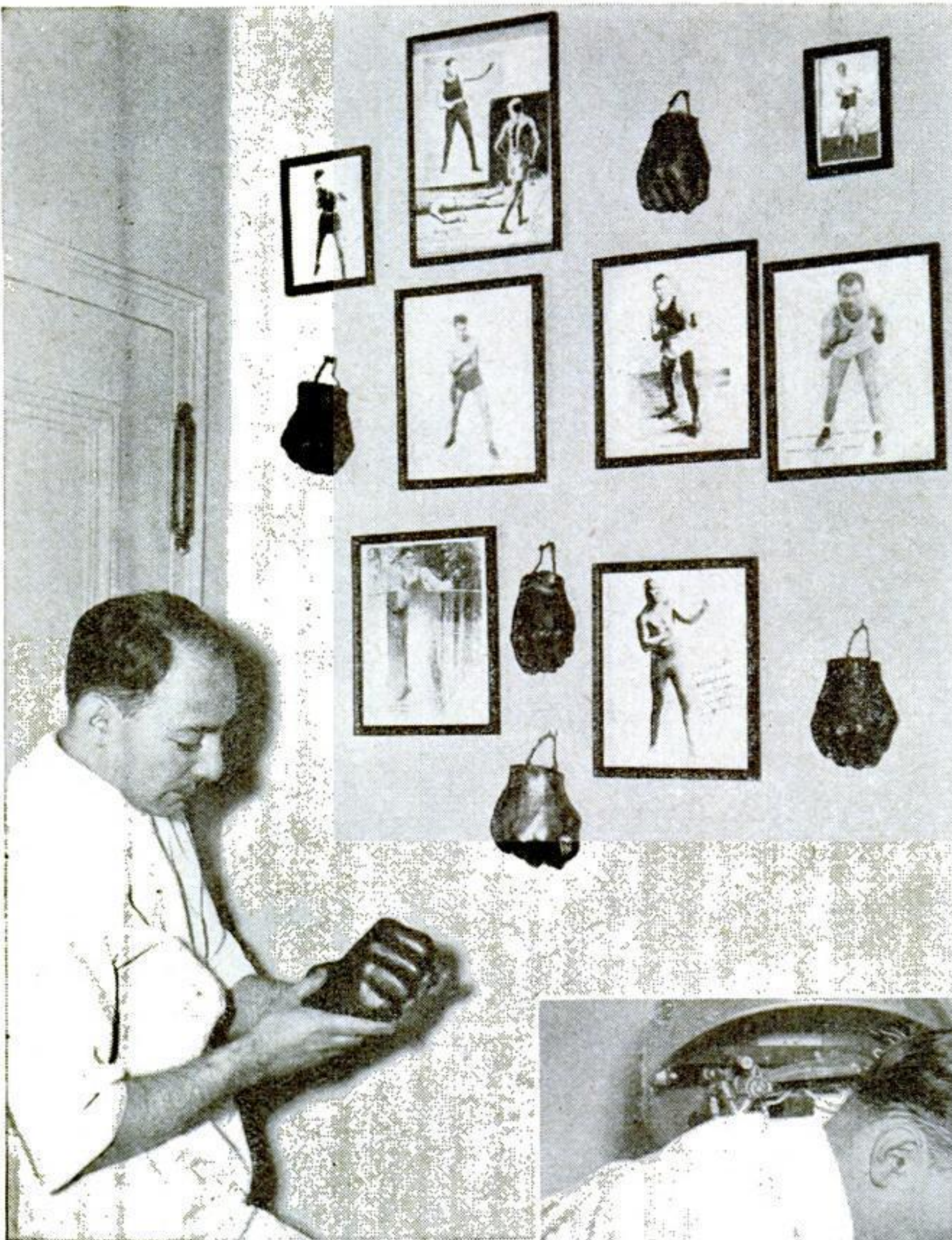


Our artist's conception of the proposed diving sphere in which Prof. Auguste Piccard will attempt to descend into the ocean six times as far as William Beebe's record dive

special electrical device capable of producing powerful electric shocks to discourage possible attacks by giant squids or other mammoth denizens of the seas believed to exist at great depths. The submarine explorers will carry a twenty-four-hour supply of oxygen, and special radio equipment for communicating with a base ship on the surface. Before making the actual descent, Piccard plans to experiment with an empty gondola equipped with an automatic device for releasing ballast, to test the novel depth-control system.

Collector Casts Famous Fists

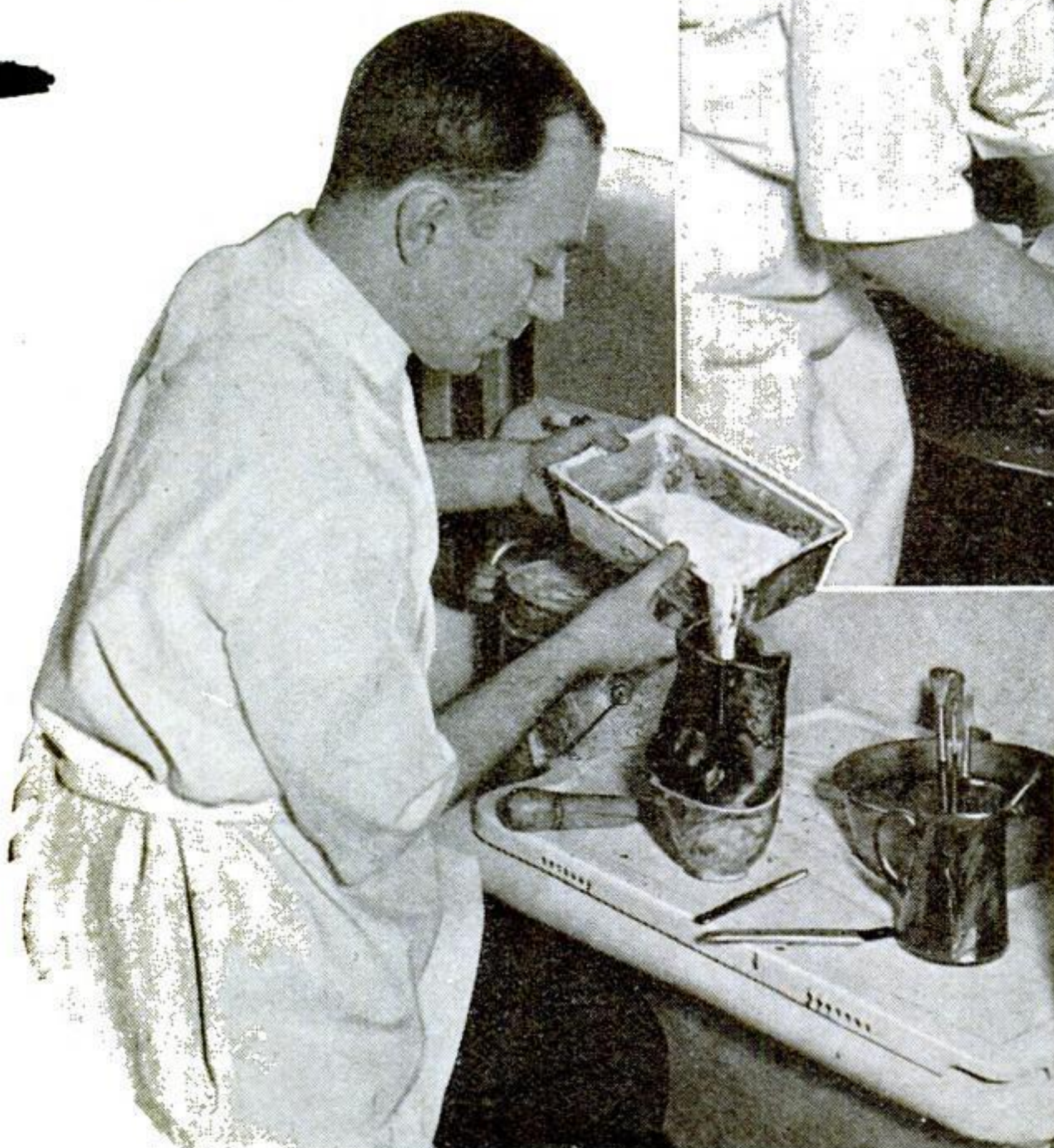
MAKING plaster casts of the fists of famous prizefighters is the unusual hobby of Dr. Walter Jacobs, New York City dentist. A "negative" mold is first made by coating a fighter's fist with a modeling compound of the type used by dentists in making impressions of mouths and teeth. When the substance is removed from the clenched hand, and has set, plaster is poured into the mold to form a lifelike reproduction. Dr. Jacobs is conducting a study of the fists of fighters of different weights and periods of ring history. In the last year and a half, the New York dentist has made copies of the fists of more than forty modern and old-time boxers.



Dr. Walter Jacobs with several of the forty-odd casts he has made of the hands of fighters



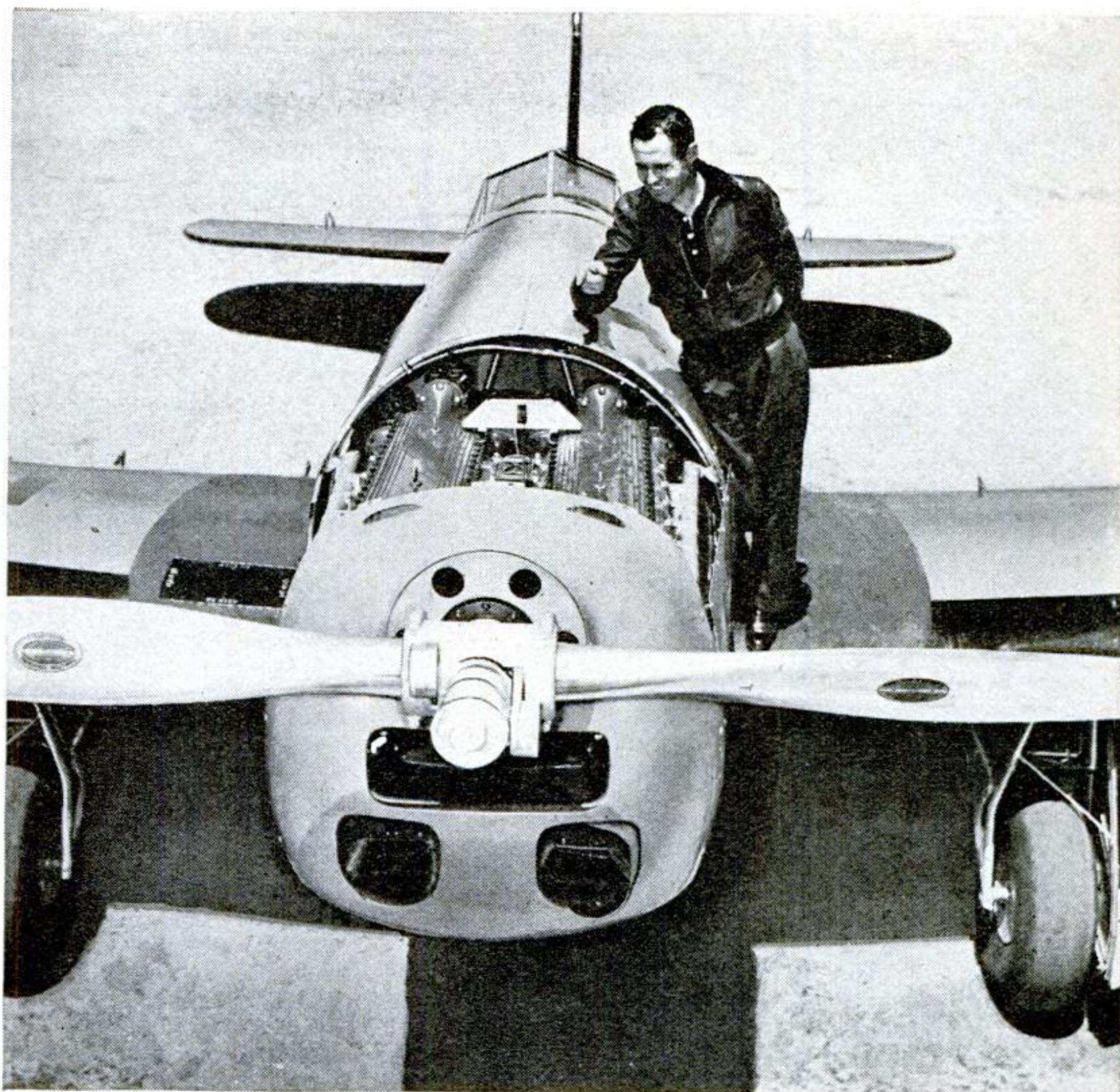
Tommy Farr, well-known heavyweight prizefighter, sits for an impression of his right hand in Dr. Jacobs's office. The dentist, accustomed to modeling patients' jaws, is using a regular dental plastic



Pouring the plaster for the permanent casts is usually done by the dentist in the kitchen of his home, as at the left. His collection of models of the fists of prizefighters includes many from the hands of ringdom's great

Twin Motors Run Plane's Single Prop

TWIN motors mounted side by side in the nose of a new monoplane now undergoing tests at Burbank, Calif., are geared to a single propeller. If either of the 260-horsepower engines should fail during the course of a flight, a "free-wheeling" gear system allows the other to take over the job alone, unhindered by any drag from the dead engine. By dividing the total horsepower between two units, safety is increased, since one engine will maintain the craft in flight in case its companion stops for any reason.



Two 260-horsepower engines are geared to the single propeller of this monoplane

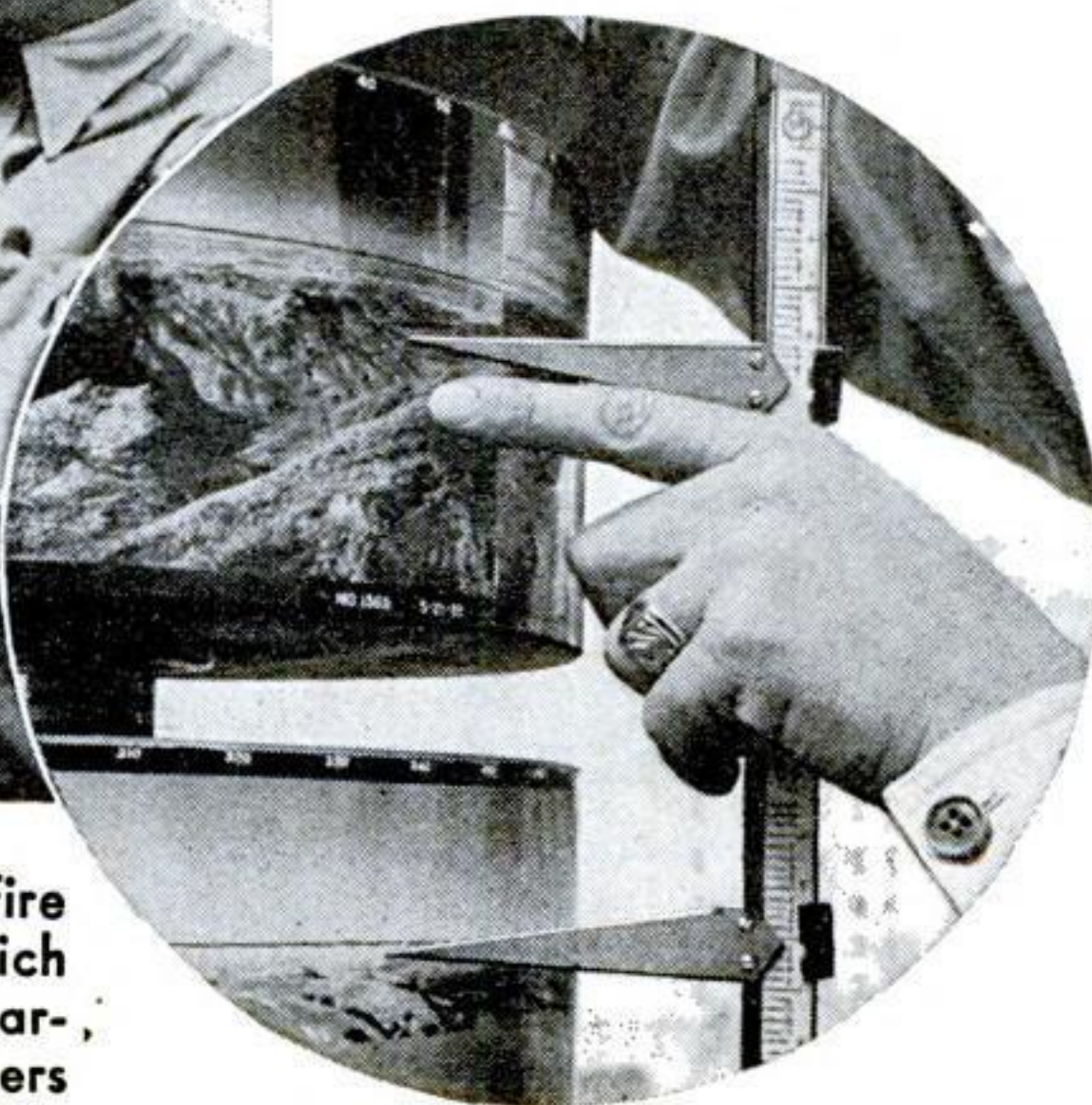
Novel Forest-Fire Finder Guides Rangers to Scene

METAL fingers point out the locations of forest fires on photographs mounted in an ingenious device invented by an officer of the San Bernardino, Calif., National Forest. Known as a rotary fire finder, the instrument consists of a rack having four rotating cylinders, on each of which is a panoramic photograph of the forest taken from a separate fire tower. When an

observer sights a fire, he points a metal finger at the site of the conflagration on the photograph. Noting down the calibrated readings on the instrument, he sends them to headquarters, where duplicate instruments are adjusted so that the metal pointers indicate the fire site on each of the photographs, enabling fire fighters to locate the scene quickly.



Metal fingers point to scene of fire on panoramas mounted on drums which are rotated in accordance with bearings reported by observers in towers





This may be the world's oldest oil refinery: an Arabian distillery using 2,000-year-old methods

Oil Refinery Running for 2,000 Years

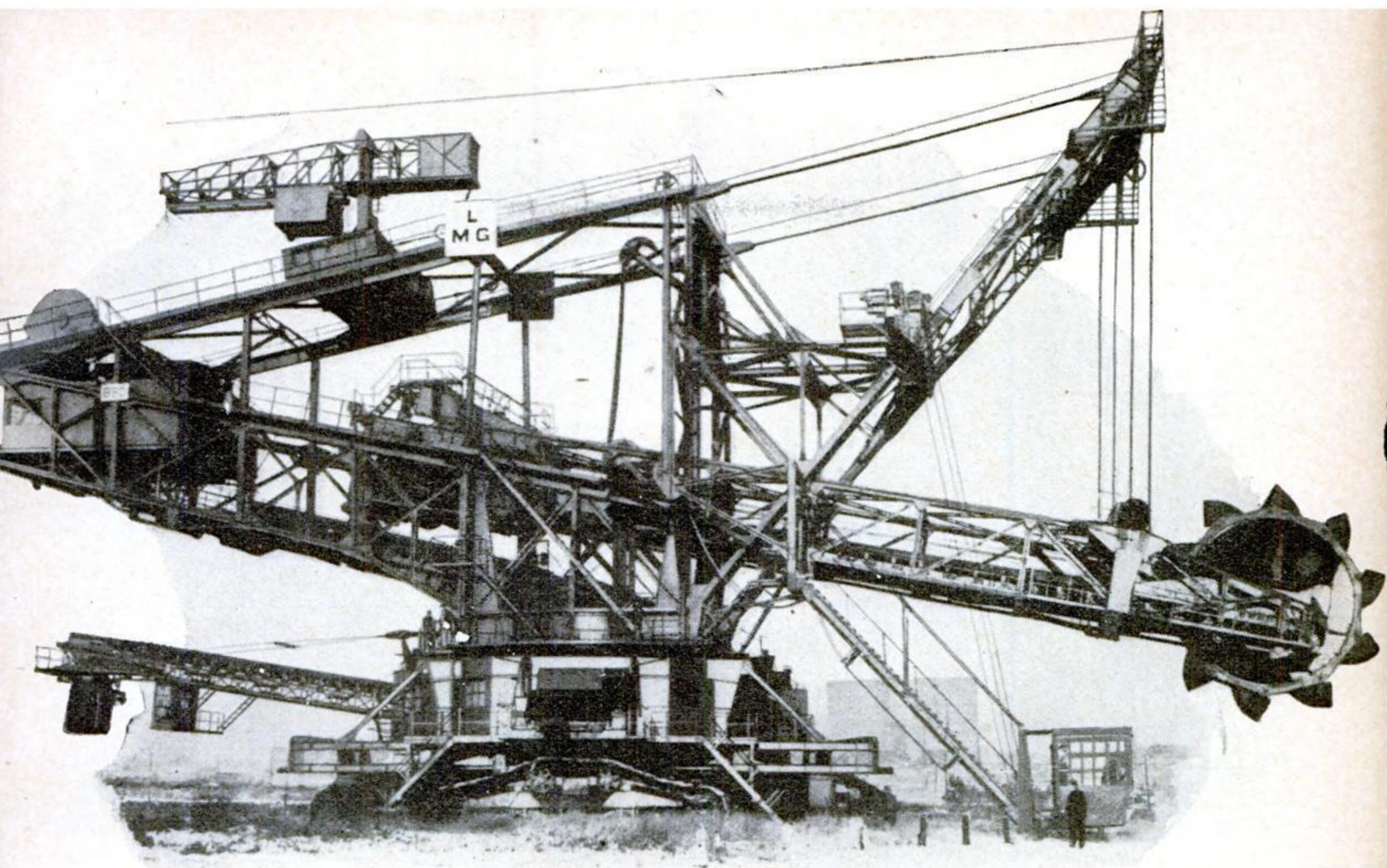


The present owner firing one of the crude retorts in which he distills petroleum. At the right is a condensing coil, with refined oil dripping from the lower end of the pipe into a container

IN CURIOUS clay buildings along the road between Kirkuk and Mosul in Mesopotamia, Arabs are refining oil by the same methods and with the same equipment their ancestors used over 2,000 years ago. A strange cluster of small structures with vaulted roofs and diminutive chimneys, the ancient refinery is owned by an Arab in whose family the business has been handed down from father to son since remote times. Kirkuk people state that an old Mesopotamian writ, dating back many centuries, mentions "wells near the caravan road which do not give water but liquid earth. A man there," the writ continues, "boils this liquid until it becomes a water that makes torches burn brighter." Experts be-

lieve that the wells mentioned are those still in operation, and that a method of distilling oil was known at that time. If the legend is true, the present owner is the operator of one of the oldest business enterprises on the earth. The photograph above gives a general view of the ancient refinery, while those at the left show some of the crude distilling equipment in use. Many travelers pass along the modern highway without realizing the unusual character of the queer structures.





Giant Coal Digger Does Work of 3,800 Men

IF YOU lined up an army of husky workmen, 3,800 strong, and set them to digging coal, at the end of an eight-hour day their combined efforts would just equal the amount of bituminous fuel mined in the same time by an

engineering giant now in action in Germany. The towering structure, shown in the photograph reproduced above, moves around under its own power, and is used to dig coal from a surface mine.

Trick Picture Shows "Biggest Boots"

A TRICK SHOT with a camera produced this photograph of "a man cleaning the biggest boots in the world." By placing his camera low and close to a pair of ordinary-size boots, while the man appearing in the picture stood some distance back, the photographer got the odd effect.

You Sing Tenor — The Record Does the Rest

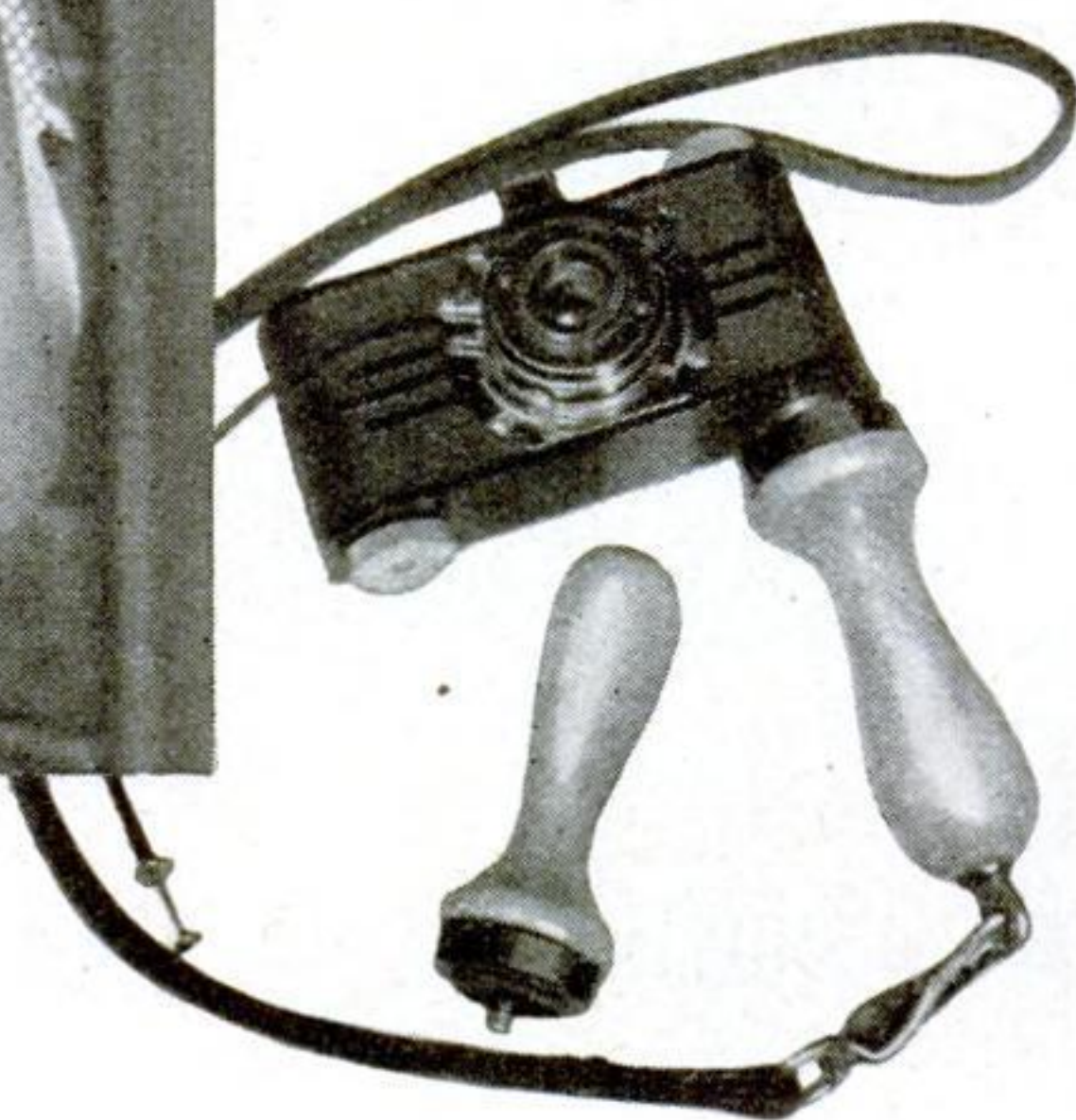
SINGERS in trios, quartettes, choruses, and other vocal-music groups can now practice their parts alone, by the use of a system of instruction invented by Richard H. Ranger, of Newark, N.J. A phonograph record supplies the other parts for the performance, while the user supplies the missing part. According to the plan, a wide selection of standard and classical songs will be available.



A low camera angle and broad focus produced this odd shot



Holding a miniature camera steady with one hand is easy with this handle. At right, how it fits into tripod socket

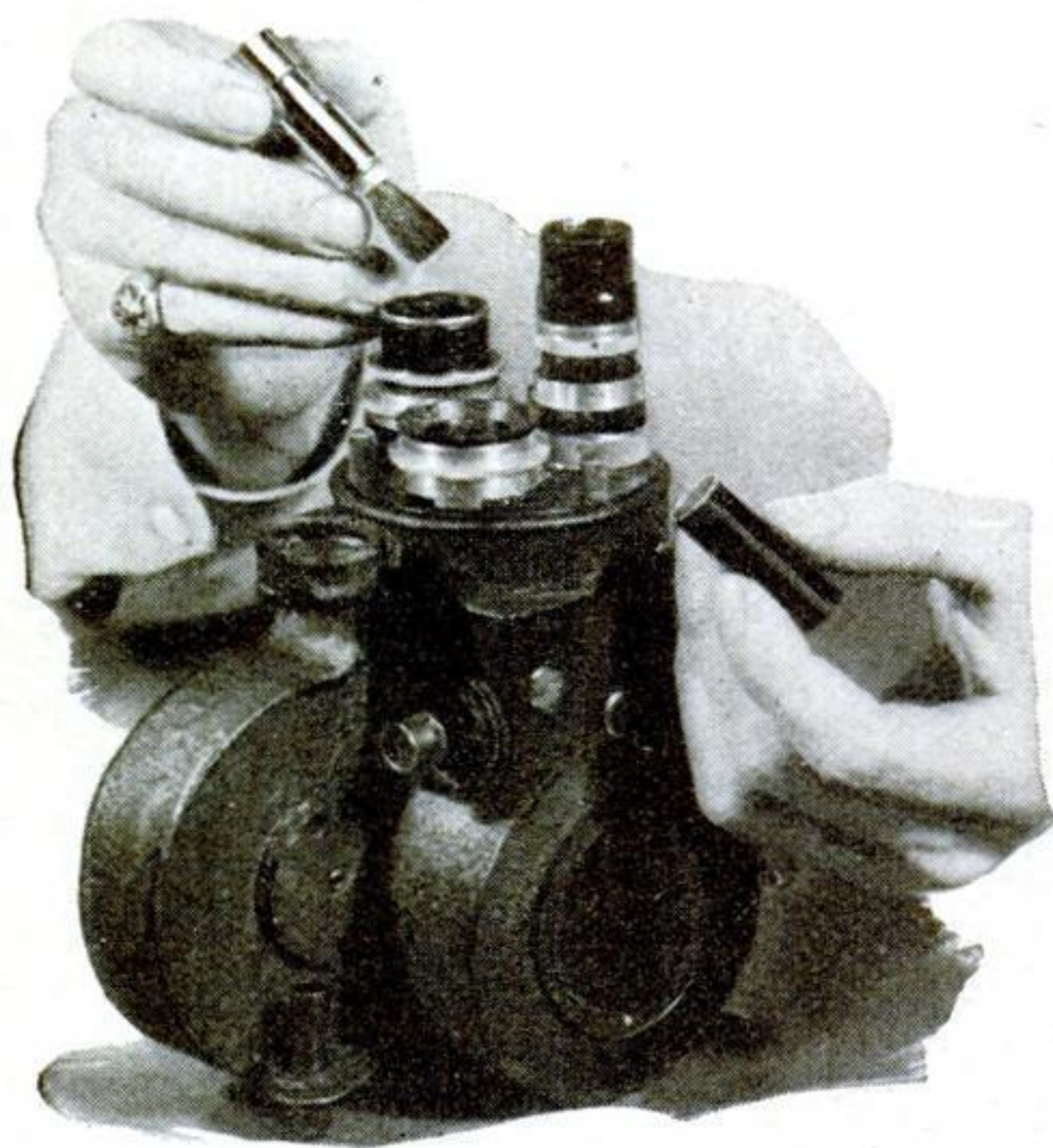


New Ideas

Handle for Small Cameras Insures Steady Shots

AS AN aid to holding miniature cameras steady while snapping the shutter, a handy wooden grip has been devised by a Florida inventor. It

screws into the standard tripod socket at the bottom of the camera and is gripped by one hand, as shown in the photograph, to hold the camera perfectly steady while pictures are being taken. A neck-strap snaps to an eye at the bottom of the grip, and is long enough to permit the camera to be carried in a coat pocket while the grip is attached.

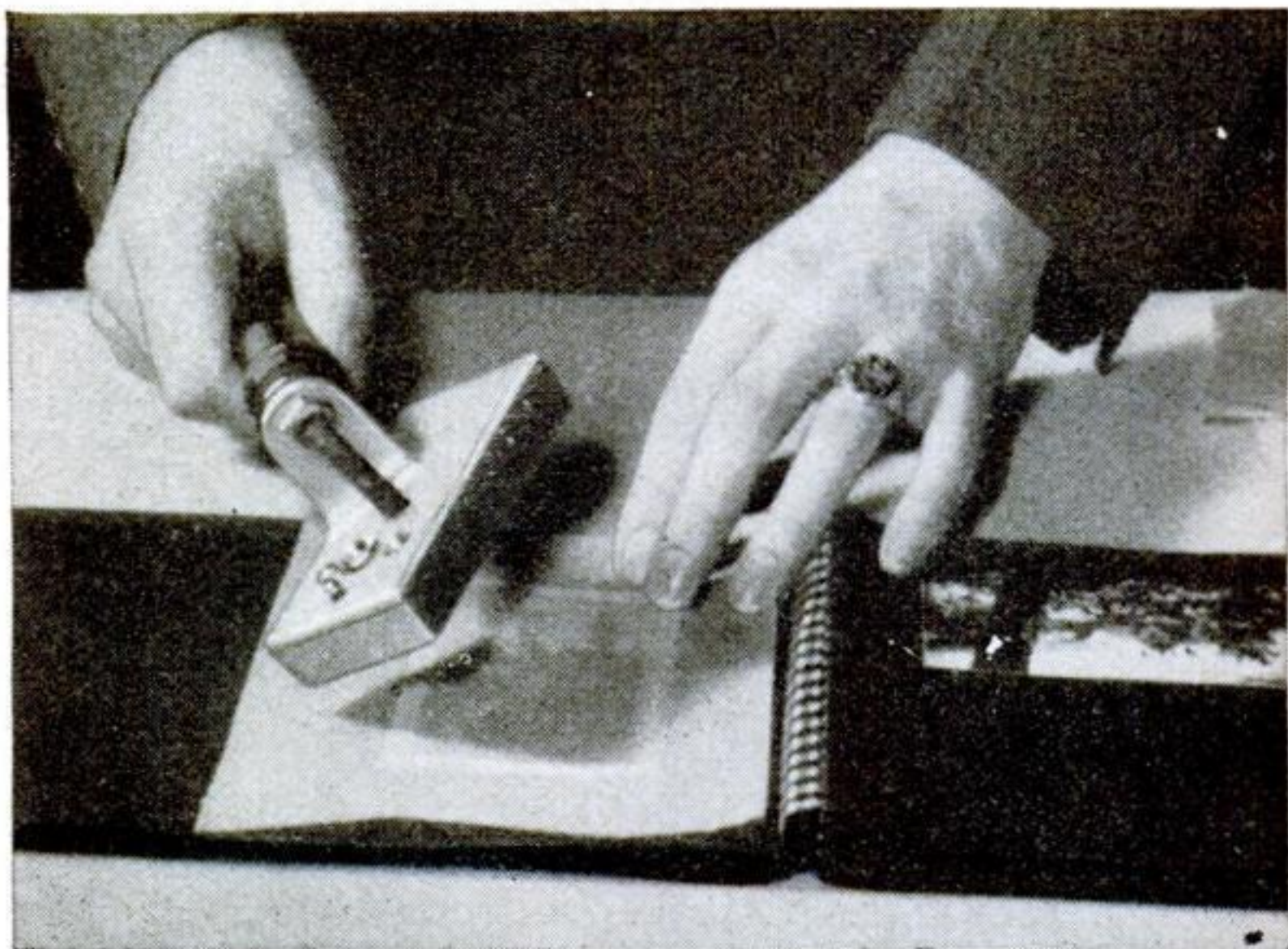


Vest-Pocket Lens Brush Has Dustproof Case

CONTAINED in a dustproof case small enough to be carried in a vest pocket, a convenient camel's-hair brush provides a quick and safe means of removing dust particles from a lens. By removing the cap and twisting the base of the container, the brush is brought into position for instant use.

Handy Electric Unit Mounts Prints Without Paste or Water

MOUNTING photographs in an album without any muss is accomplished by means of a special dry tissue, and the compact new electric heating device shown below. Pressed down on the print under which the tissue lies, the 110-volt heater quickly turns the tissue into an adhesive. A thermostat prevents the heater from becoming too hot.

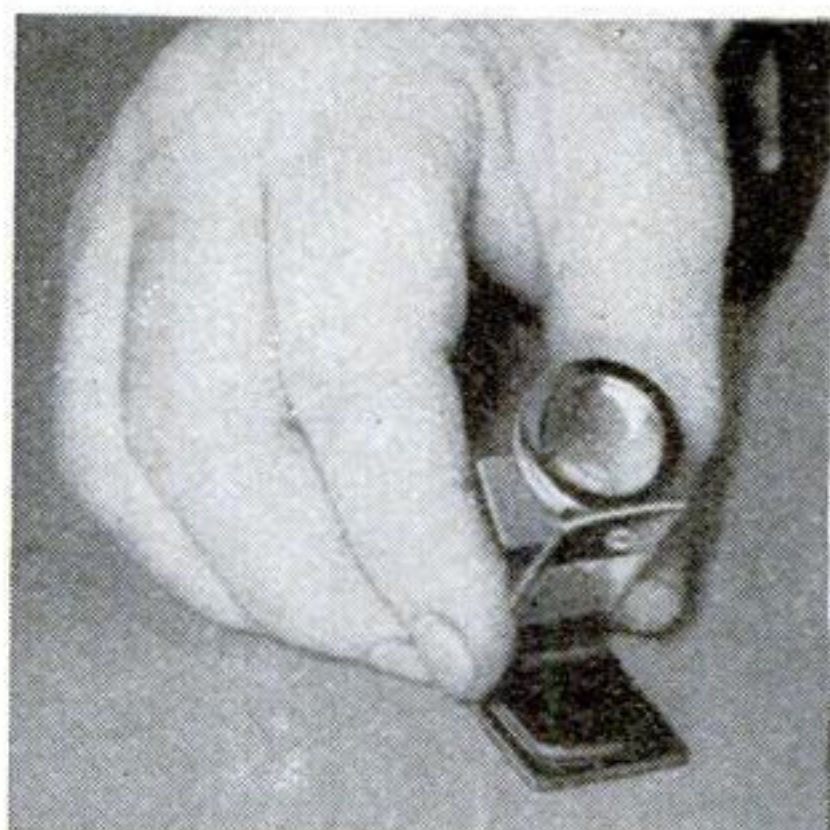


Special tissue placed under the print becomes adhesive as heat is applied, gluing the print to the album page

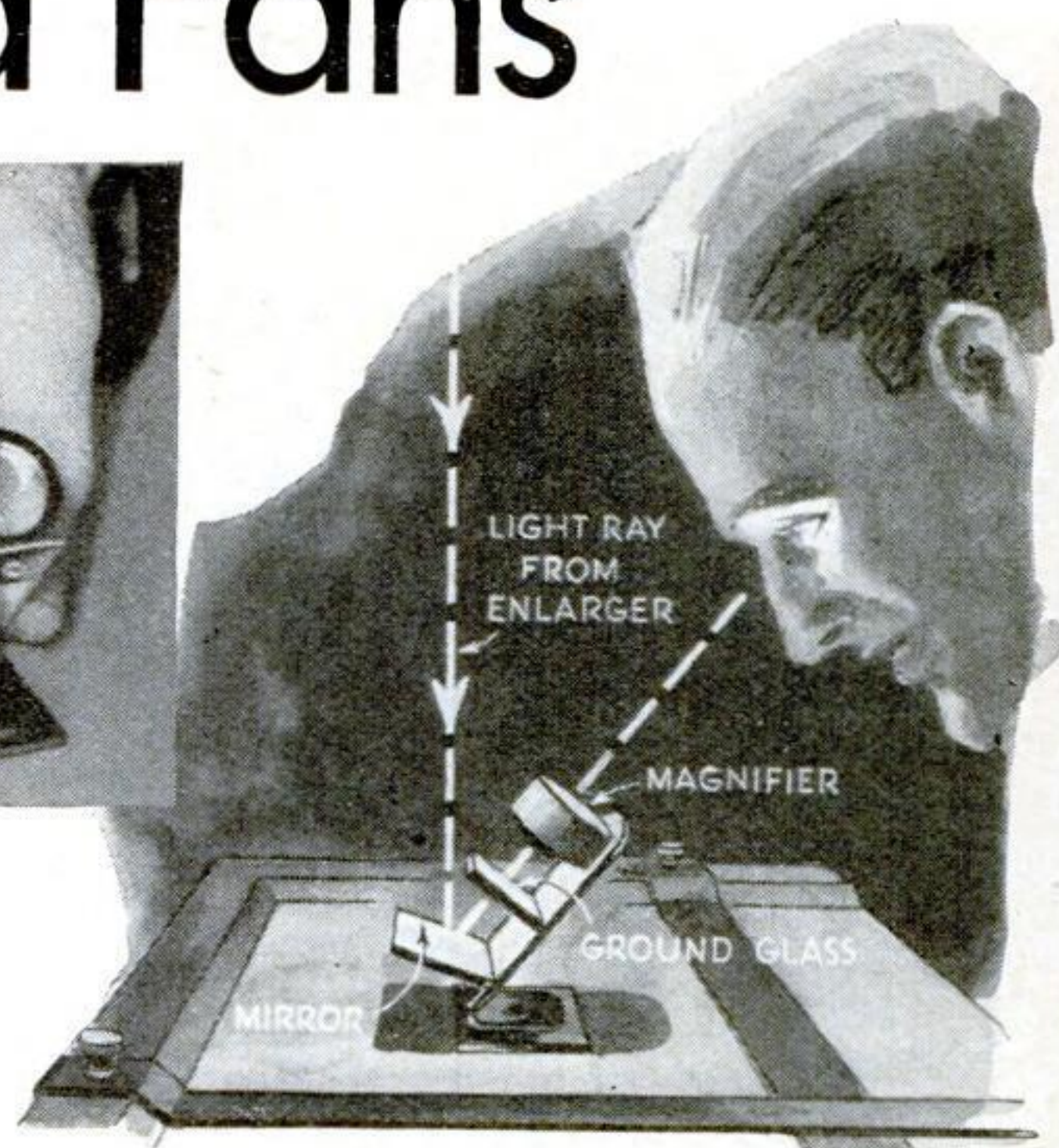
for Camera Fans

Midget Focuser Aids Enlarging

TO SIMPLIFY the problem of getting enlargements in perfect focus, an eastern manufacturer has marketed a handy unit consisting of a mirror, a ground-glass screen, and a magnifier, mounted one above the other on a metal base. The device is placed on the easel and the enlarger is adjusted until the image in the magnifier is sharp.

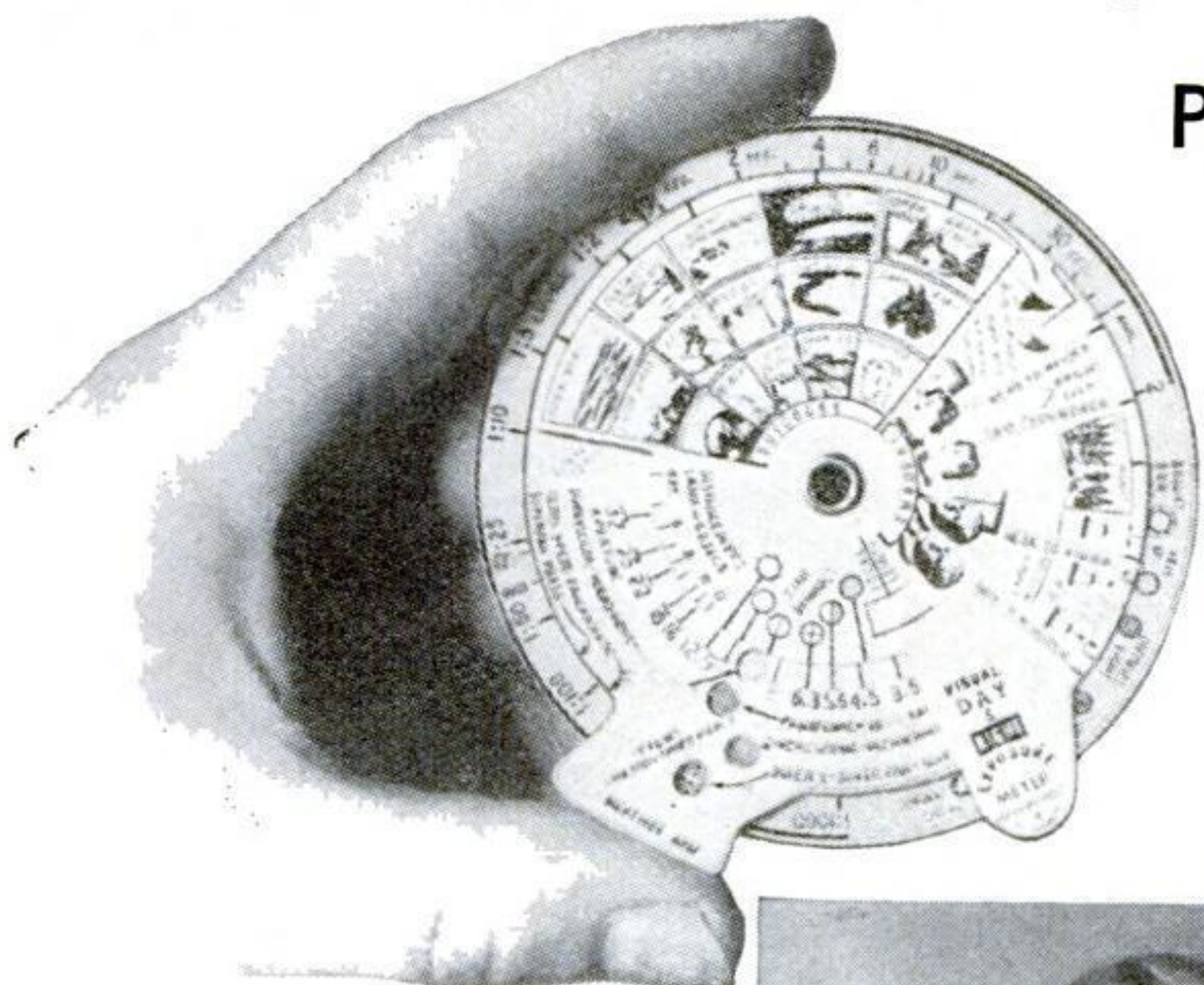


Enlargements can be brought to a sharp focus with the device shown in use at right



Pictures Replace Figures on Exposure Guide

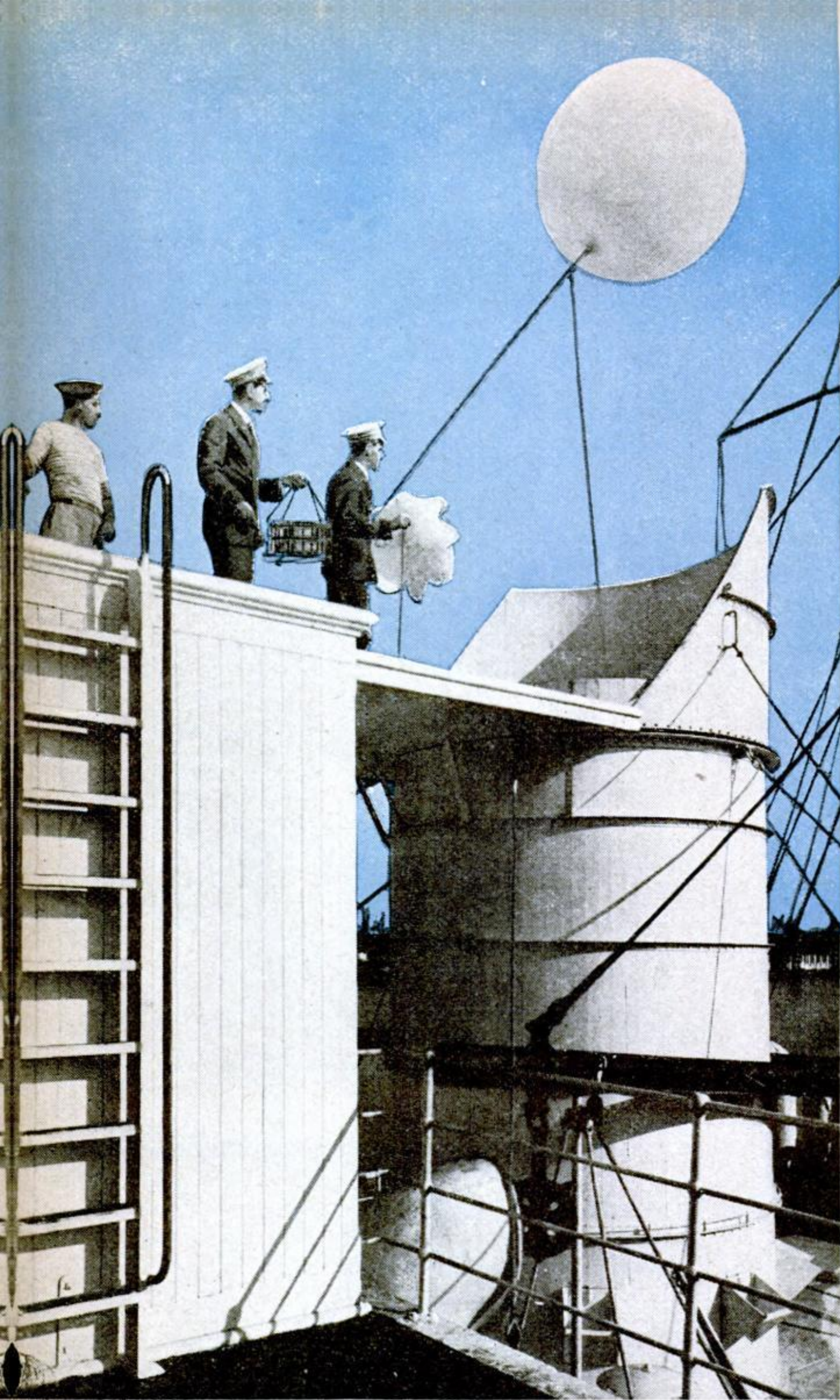
USING pictures to represent possible photographic subjects, a new exposure guide provides a wide variety of information. By rotating the top two disks of the three superimposed units, the amateur can discover the correct exposures for different types of subjects, pictured under various lighting conditions, for still and movie cameras, and for black-and-white and natural-color films.



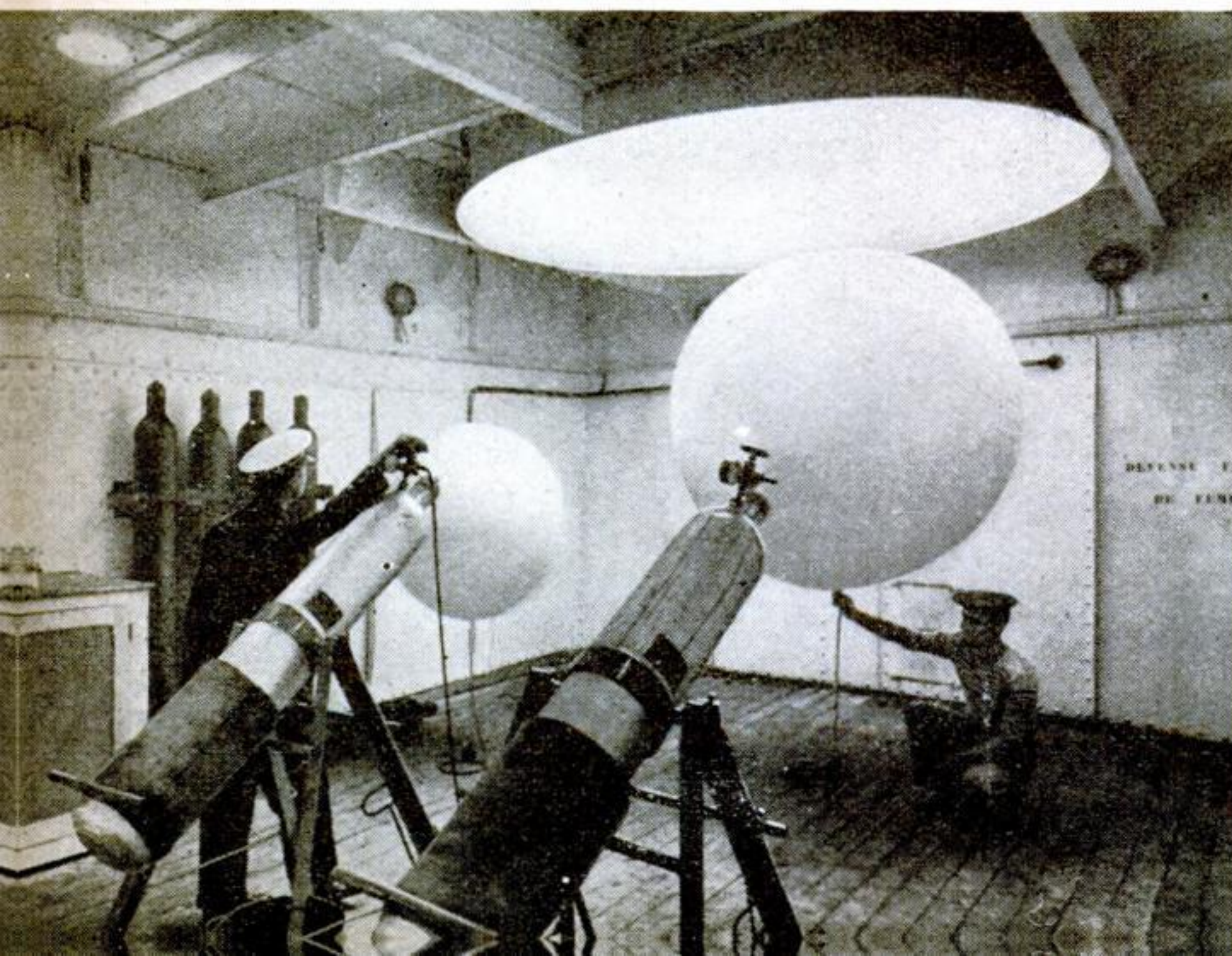
Slide Viewer for Miniature Films

MINIATURE-CAMERA fans now can study their tiny negatives by means of a convenient viewer. The device can be used with either black-and-white negatives or natural-color transparencies. A three-inch lens projects the image from the film onto a ground-glass diffusing screen two inches square. Illumination is provided by a fifteen-watt bulb. The housing is ventilated to prevent damage to the negatives from the heat.



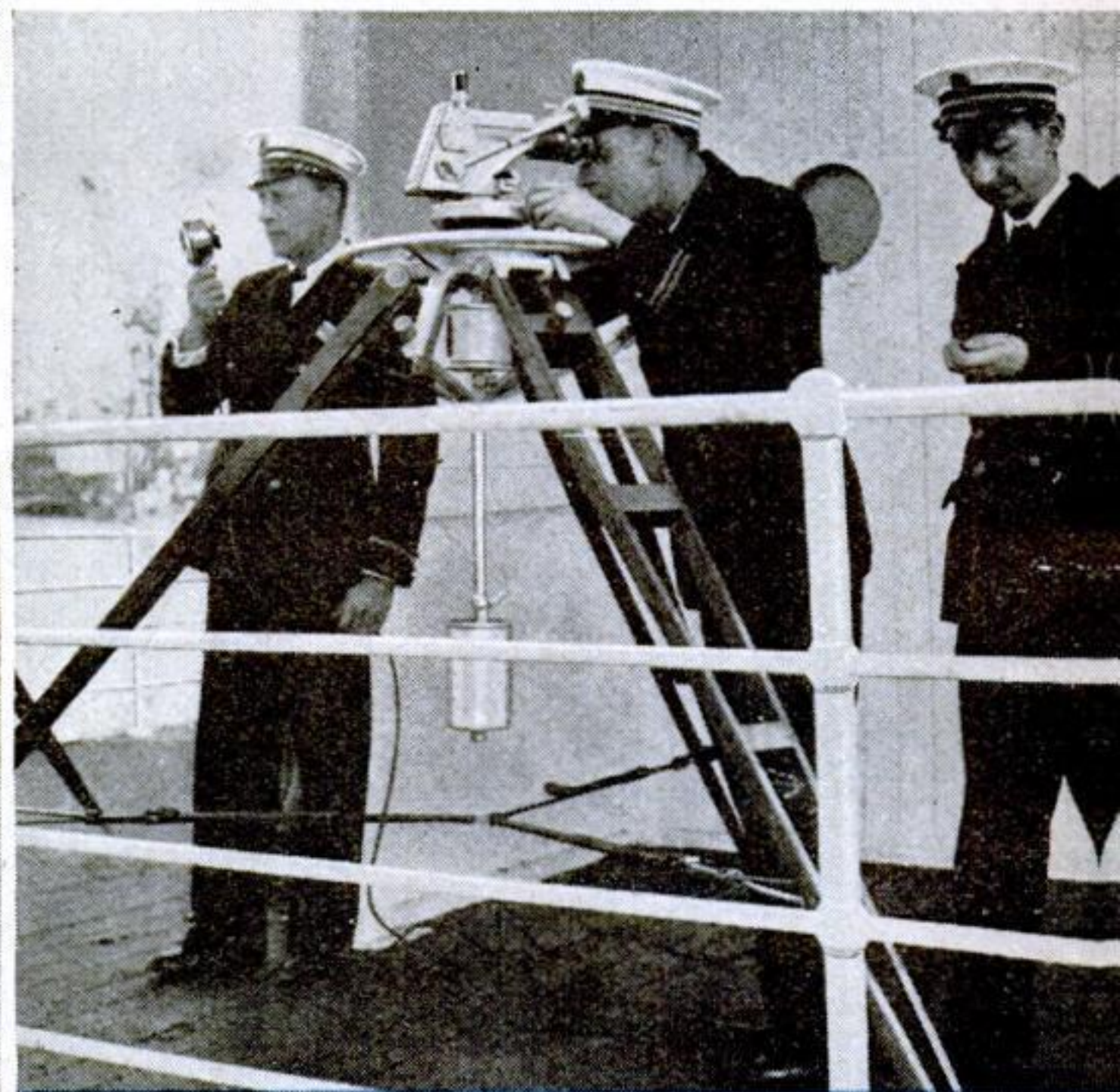


After being filled with hydrogen gas in the special meteorological cabin shown below, the weather balloons are released through the tunnel. In the photograph above, an automatic radio meteorograph is being attached to a captive balloon for a trip aloft

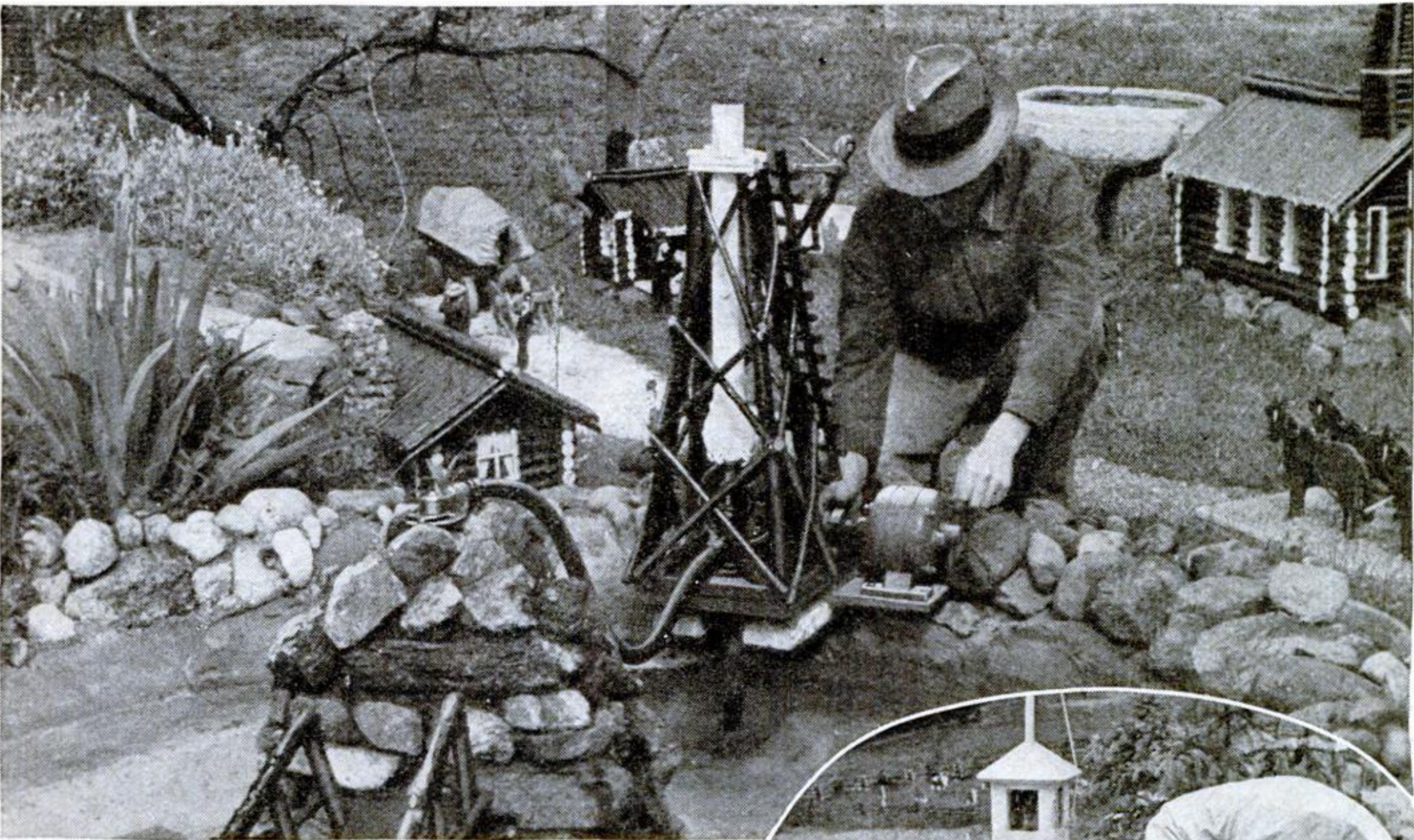


Ship Has Tunnel For Releasing Weather Balloons

PROJECTING up from the superstructure like a giant smoke funnel, a novel "wind" tunnel now used on several French liners makes it easier for the ships' officers to release the gas-filled balloons used in making meteorological observations. Running upward from a special cabin below decks, the vertical tunnel enables free balloons to rise clear of the ship's rigging, despite the eddies and cross-currents of surface winds. The balloons are inflated with hydrogen stored in cylinders mounted in the weather cabin, and are then released up through the shaft. Free balloons continue their rise into the upper air above the ship, while officers on deck observe their speed and direction of movement by means of an angle-measuring device called a theodolite, thereby gaining valuable information concerning the force and direction of air currents at various altitudes. Balloons of the captive type, released up through the tunnel, are checked at bridge level, where a radio meteorograph is attached by a cable. This instrument automatically radios data on temperature and humidity.



By following the course of a free balloon with an angle-measuring theodolite, the ship's officers can gauge the direction and force of the winds at various levels



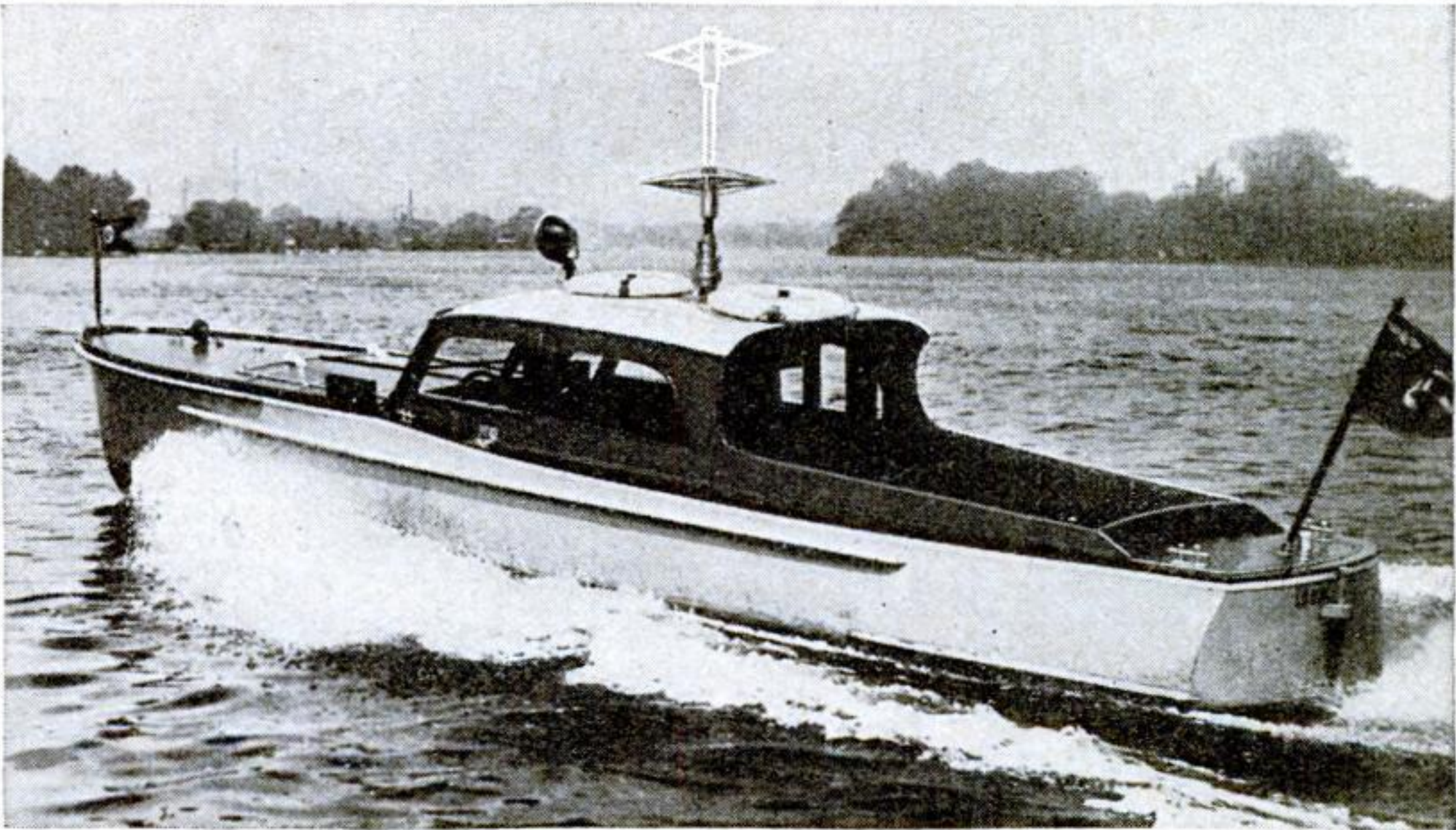
Model Maker Builds Miniature Village

MINIATURE buildings and scenes of early American history attract sightseers to a "midget village" built by W. C. Houser in his garden near Akron, Ohio. A model sawmill of Revolutionary days and a near-by grist mill really work, run by a stream kept circulating by a homemade electric pump. An electric-powered model of an early Pennsylvania oil derrick operates a fountain. In one of the buildings, dolls do a Maypole dance to music provided by a full-sized phonograph.

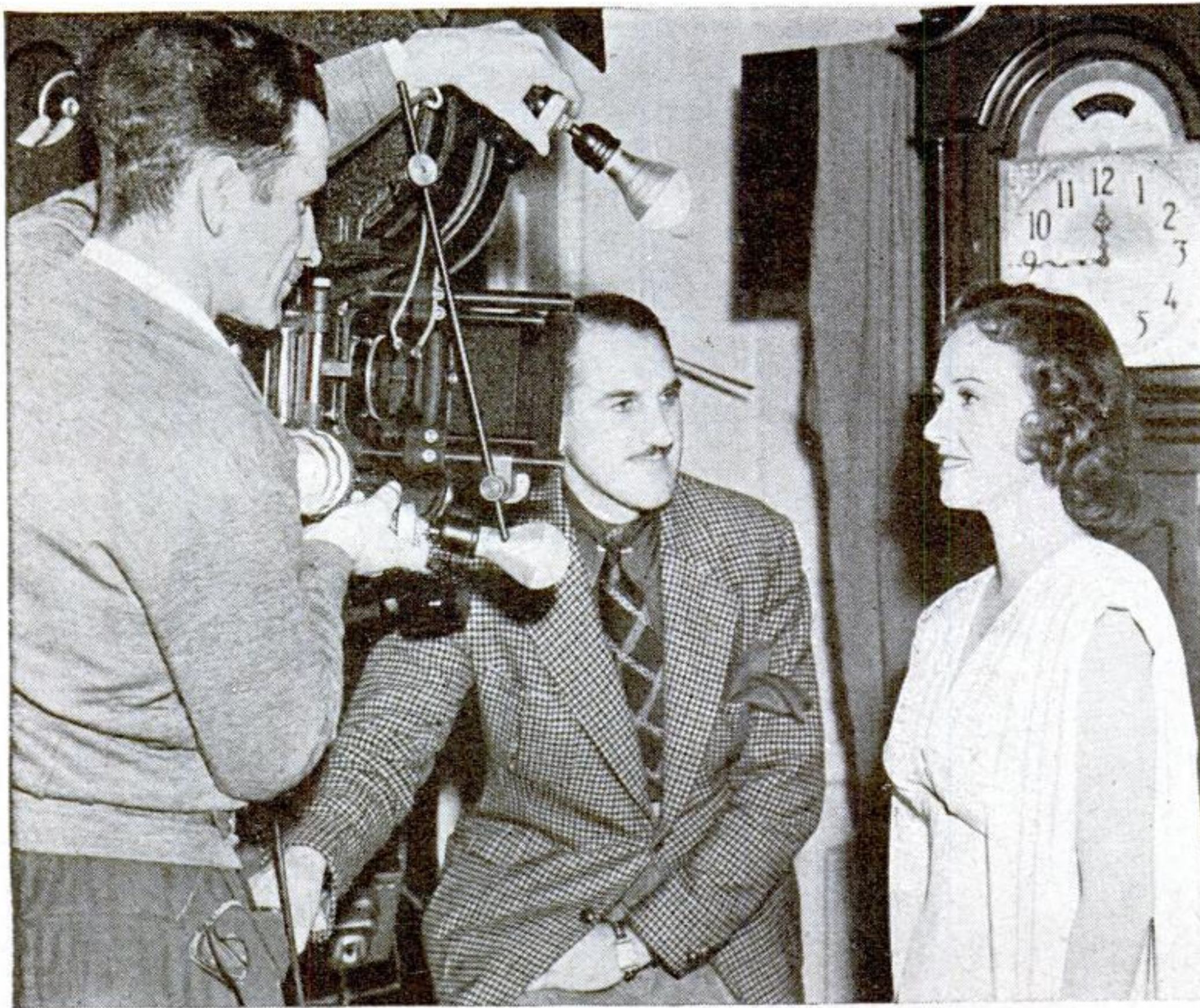
W. C. Houser, model maker, winds the phonograph and adjusts the water pump in his log-cabin village

Telescoping Radio Antenna for Small Boats Tested

TO SOLVE the problem of efficient transmitting and receiving antennas for radios installed on small boats, the novel telescoping device pictured at the right is being tried out on German coast-guard cutters. Although the new antenna is fitted with a square plate at its top, it is similar in design to the "fish-pole" type now in common use on automobiles. Extended, it reaches to a height of fifteen feet.



Telescoping antenna installed on a German cutter. Drawing shows it extended



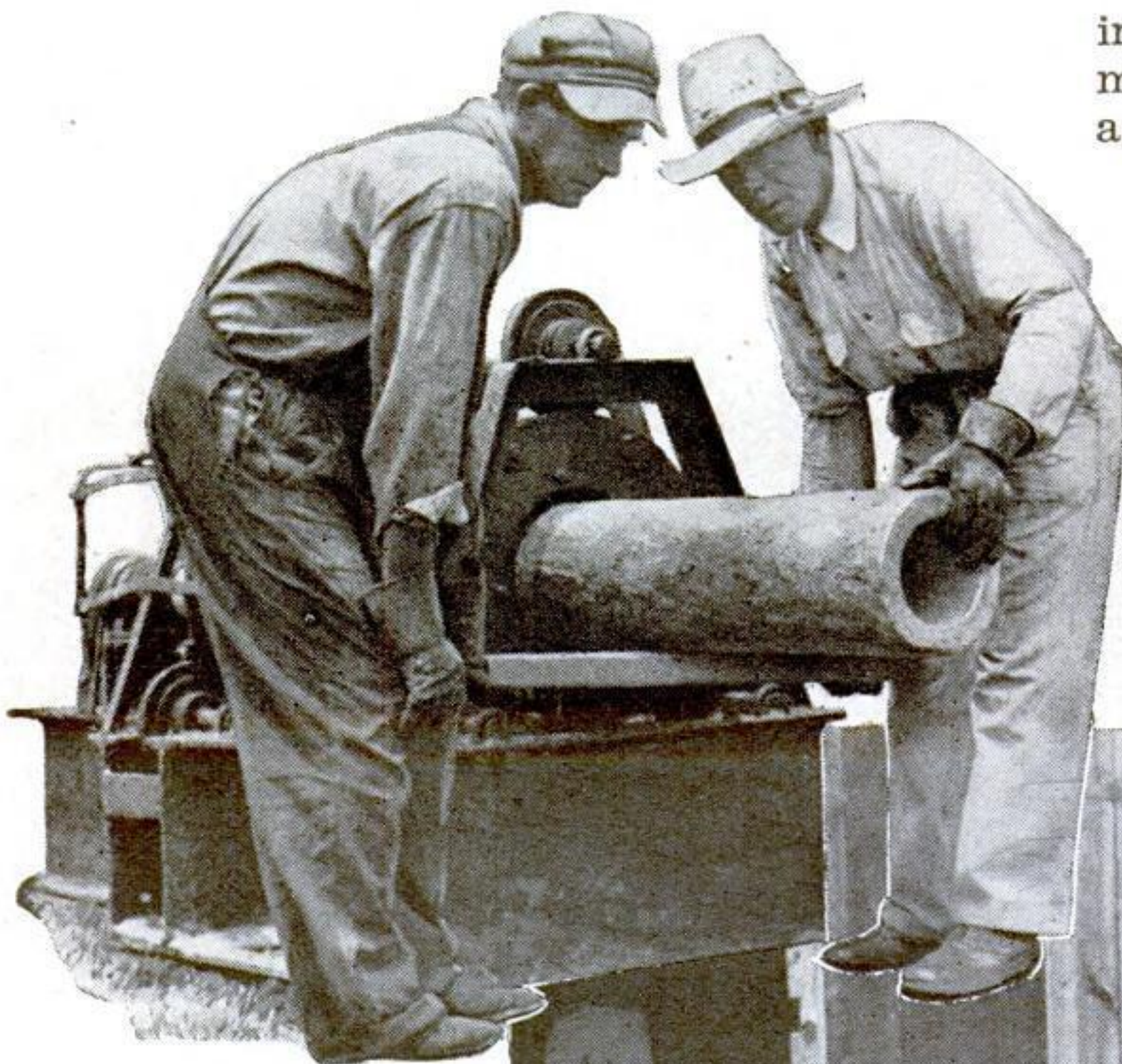
Silvered Bulbs Light Movie Close-Ups

ELECTRIC bulbs no larger than those used for household lighting are now being employed by Hollywood motion-picture studios for making close-up scenes in films. Silvered on the inside to reflect concentrated light on the face of an actor, two bulbs, one sixty-watt and another twenty-five-watt, are sufficient for head-and-shoulders shots. Under old methods, three small spotlights using a total of 1,500 watts were required. The new bulb is a handy light source for home-movie fans.

In use, the new close-up movie lights are mounted directly on the camera

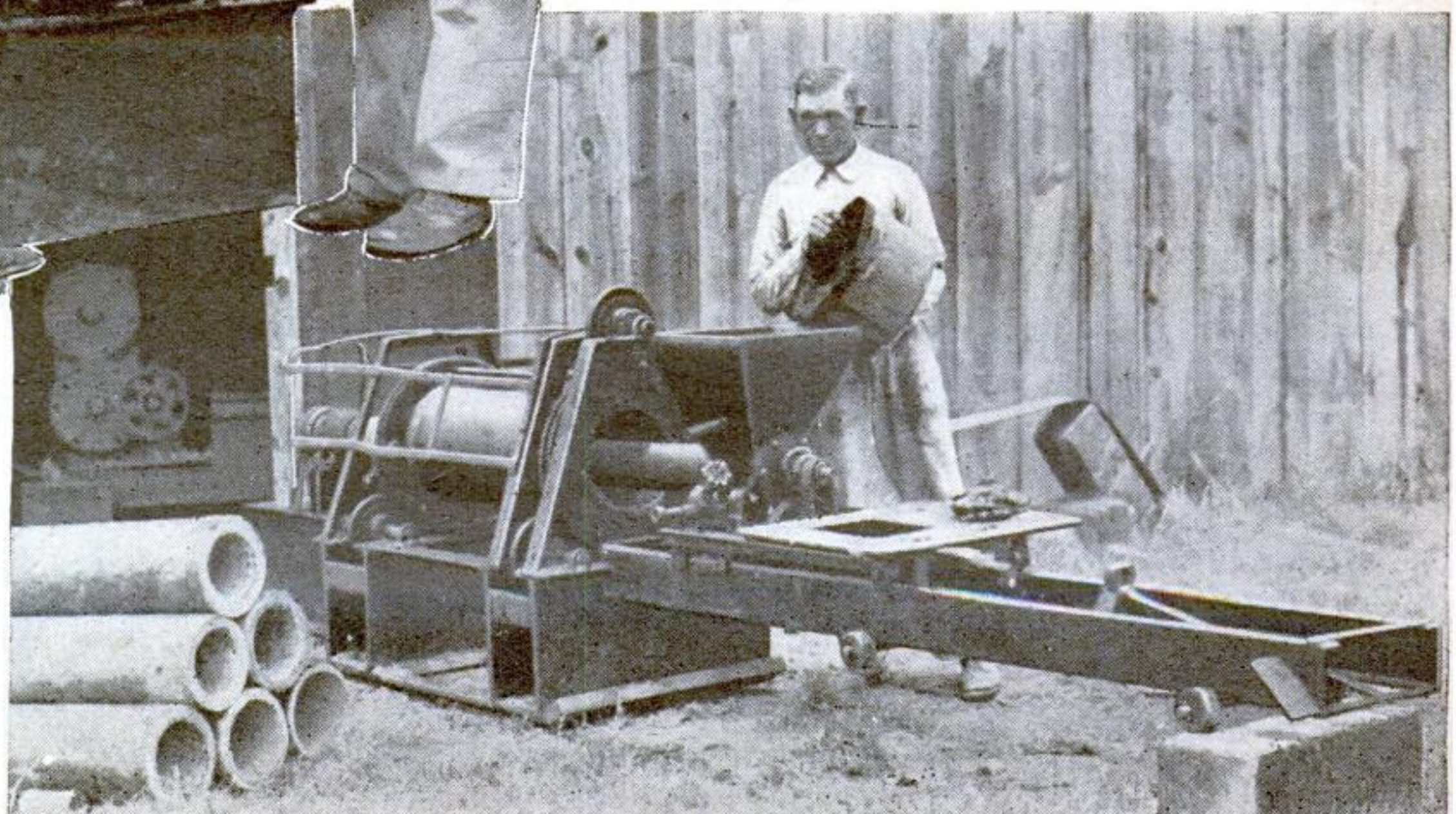
New Water Pipe Cast with Sulphur Resists Corrosion

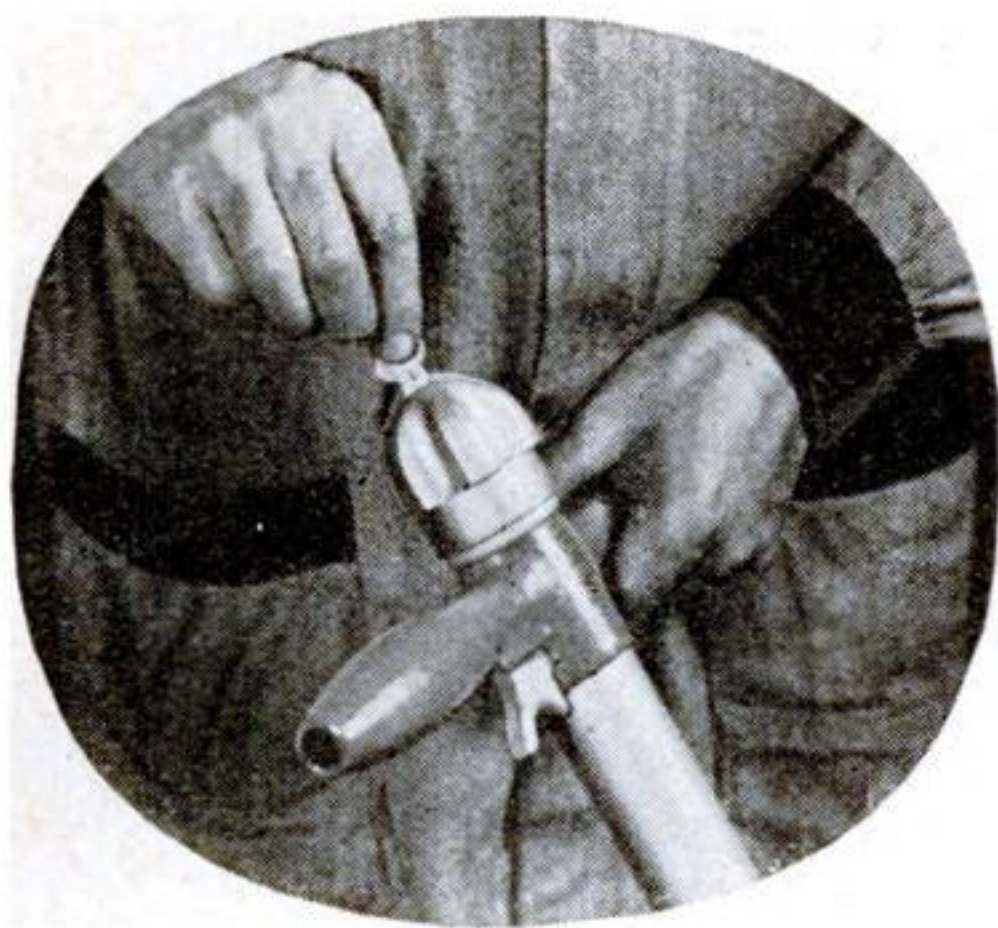
HIGH resistance to corrosion and weathering is claimed for a new type of cast pipe made with ordinary sulphur as the cementing agent to combine sand, shredded asbestos, and a coarse aggregate such as coke. The raw materials are dumped into a centrifugal casting machine, heated, and fed by means of a spiral conveyor into the rotating casting chamber, which turns at the rate of 1,000 revolutions a minute. Circulating cold water hardens the molten materials as they are held in place against the inner surface of the whirling mold by the action of centrifugal force.



Above, removing a cast pipe from the centrifugal molding machine

Charging the casting machine with a mixture of sulphur, sand, asbestos, and ordinary coke



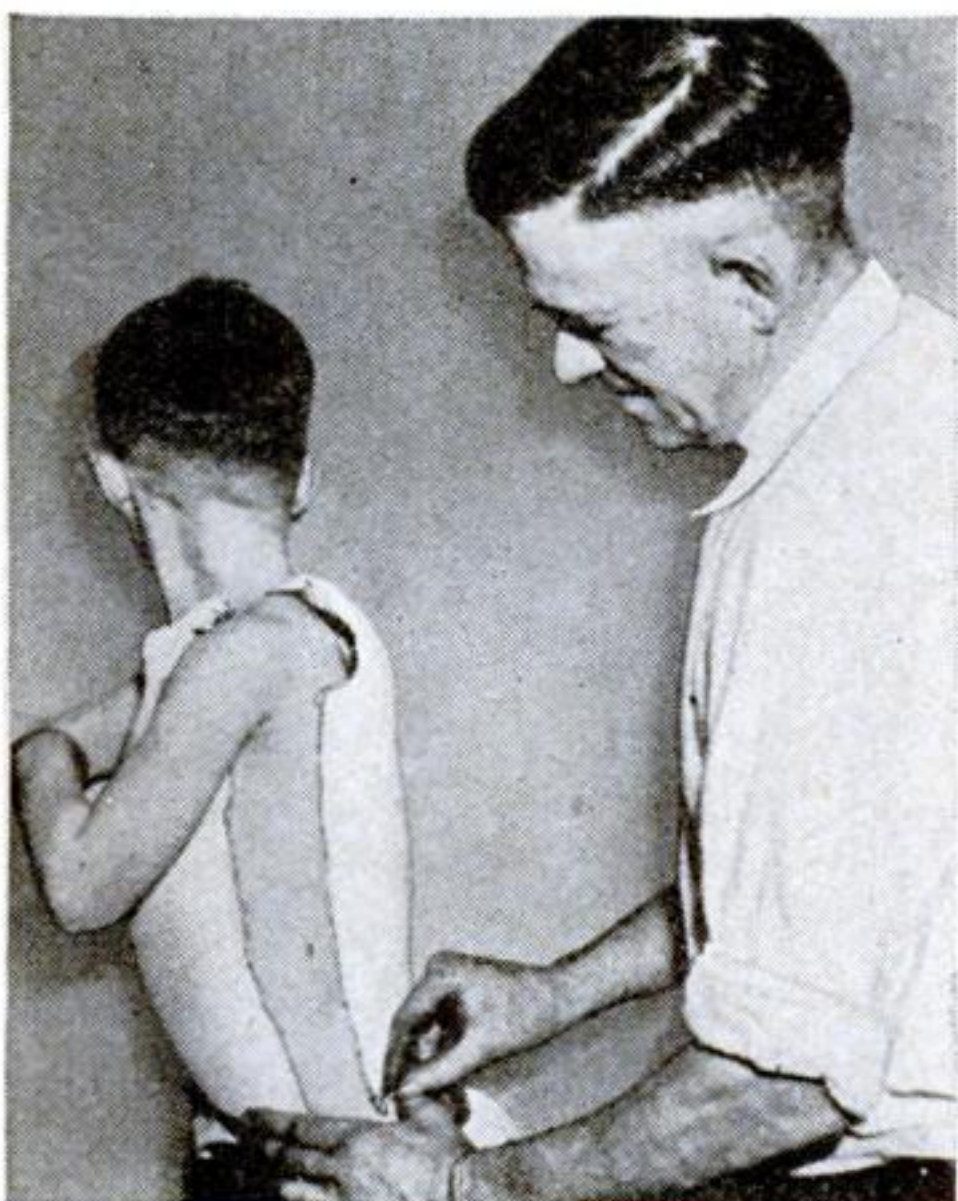


New Jack for Cars Has Safety Lock

DESIGNED for the safety of mechanics working under a jacked-up automobile, a new safety attachment enables a workman to lock the jack in place. Once locked at any height, the jack cannot be lowered until the mechanic inserts a special key in the mechanism. The lock does not interfere with the conventional use of the jack.

Plaster Cast Uses Slide Fastener

A SLIDE fastener attached to a plaster cast, the invention of Harry M. Gillen of Philadelphia, Pa. makes it an easy matter for a physician to remove a leg or back cast for periodic inspection. The fastener is of the type commonly used on clothing and leather goods.



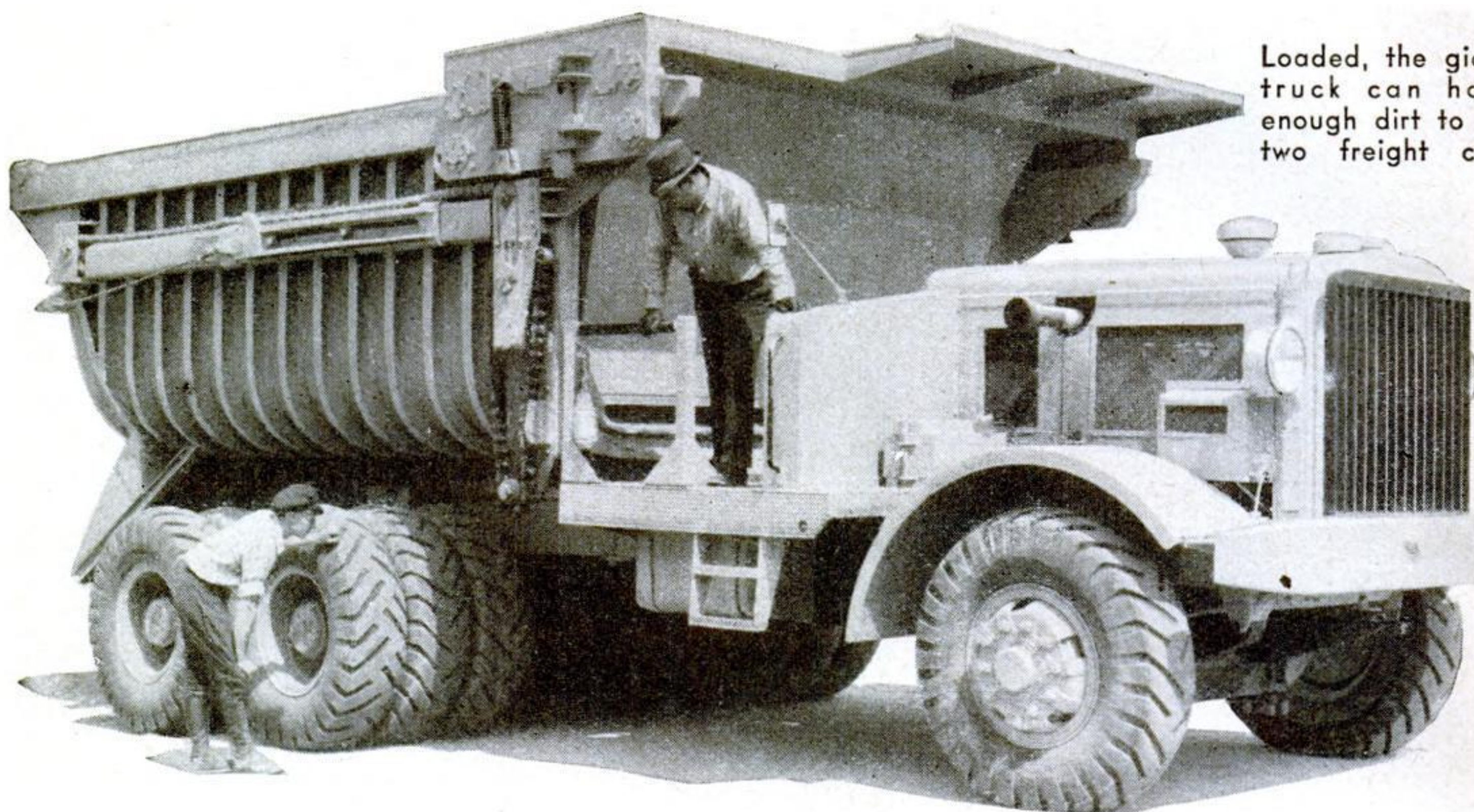
The plaster cast can be removed easily for physical examinations



Like a "crazy house" at an amusement park, this leaning building provides fun for tourists

House Tilted by Flood Becomes Exhibit

WHEN flood waters tipped her house over at an angle, Mrs. Minnie Ferris of Smithville Flats, N. Y., nicknamed it the "Crazy House," charged curious visitors an admission fee, and turned disaster into a paying proposition. Cash customers enter through the cellar, climb stairs that tip sidewise at a rakish angle, and walk up and down hill across the floors of the dizzy dwelling.



Loaded, the giant truck can haul enough dirt to fill two freight cars

Fourteen-Wheel Truck Has 152,000-Pound Capacity

HAULING enough dirt to fill two freight cars at each loading, a gigantic dump truck recently built for an Alhambra, Calif., firm is powered by a mammoth eight-cylinder Diesel engine which requires a supplementary two-cylinder engine to start it. The fourteen-wheel road giant, operating at a total fuel

cost of only fifteen cents an hour, has twelve forward speeds and three in reverse. Steering is accomplished through a hydraulic mechanism. Both the clutch and brakes are operated by compressed air, and it is capable of attaining a speed of twenty-five miles an hour along a level road.



This rare albino turtle has a white body and pink shell. One of its eyes is pink, one blue

Zoo Gets Rare Albino Turtle

A RARE albino turtle just presented to the Central Park Zoo in New York City has a pink shell and a white body. One eye of the curious amphibian is colored blue while the other one is pink. The rarity was brought to this country by Louis Kasin, an explorer, who recently returned from an extensive expedition in which he penetrated into the jungles of Colombia, South America.

New Chin Strap for Helmets

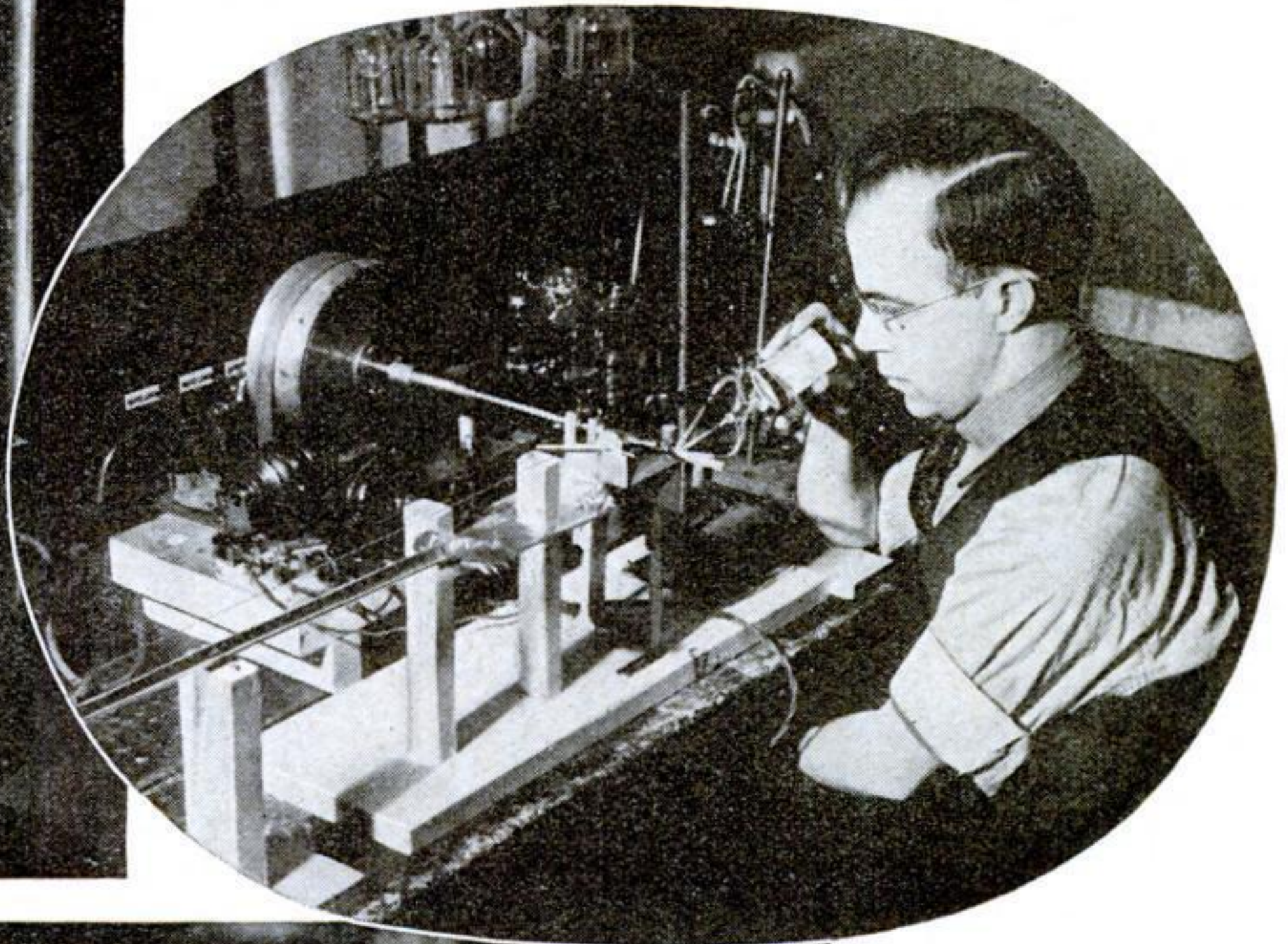
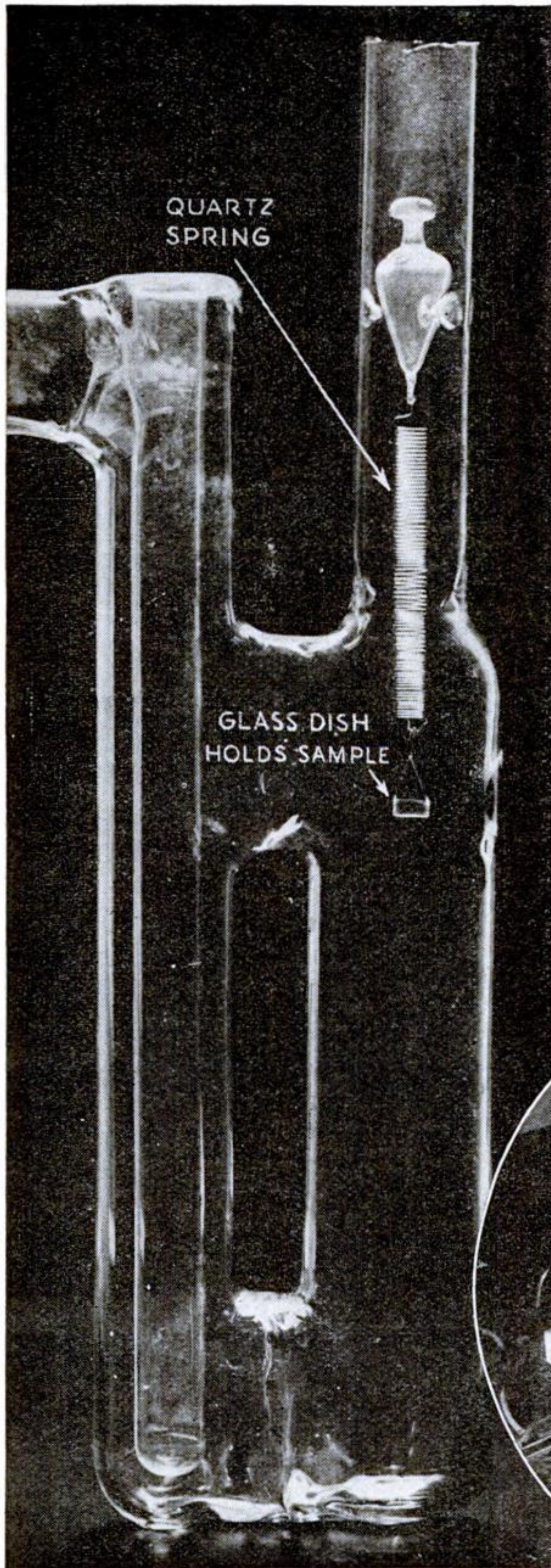
INSTEAD of running under the lower jaw where it may chafe the throat of the wearer, the chin strap of a new type of aviator's helmet designed by the U.S. Army Air Corps is anchored against the point of the chin, as shown at the right. The new design does not interfere with talking, it is said.



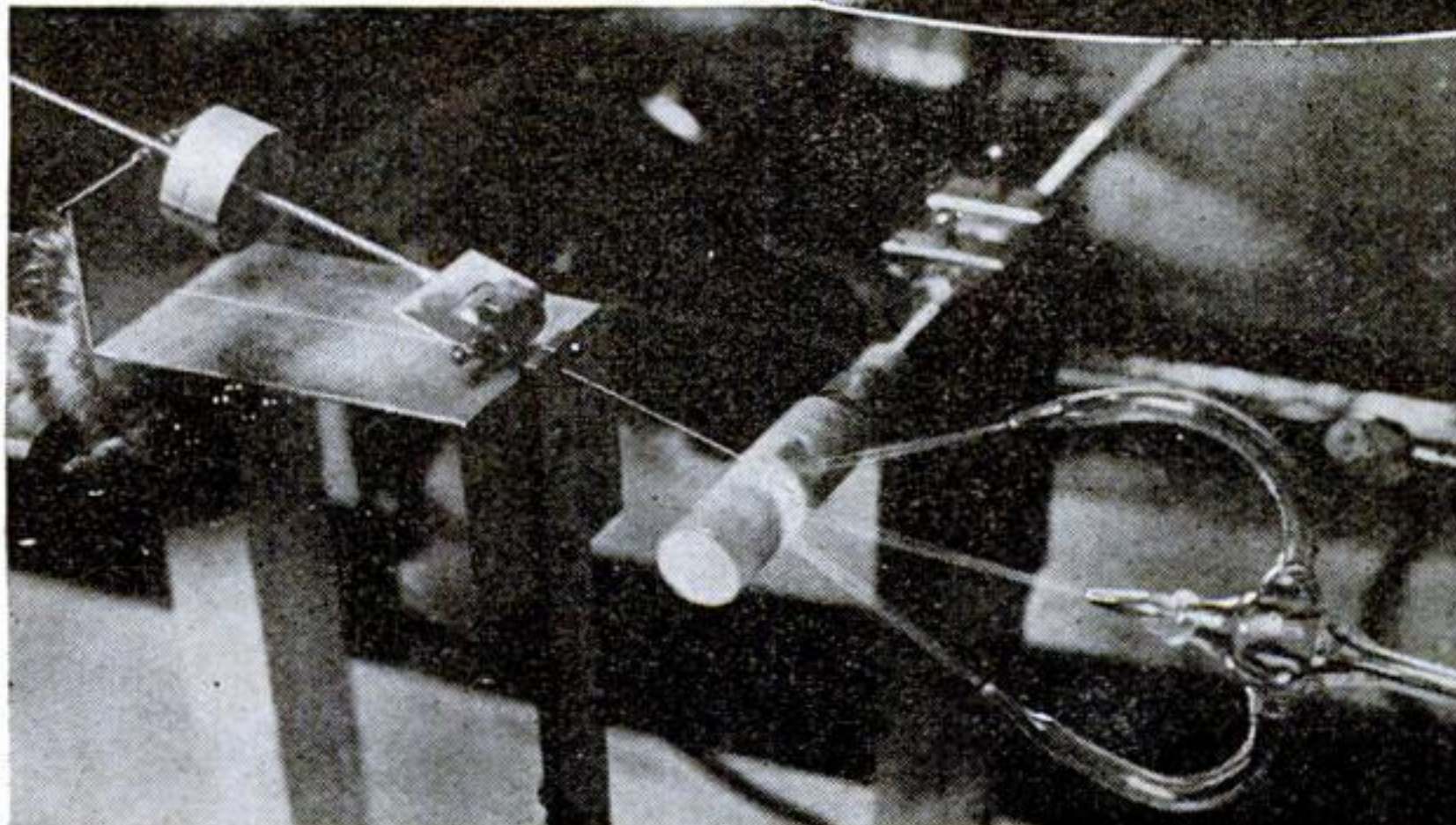
How strap of the new flying helmet fits the chin

Weighing Machine Has Fused-Quartz Spring

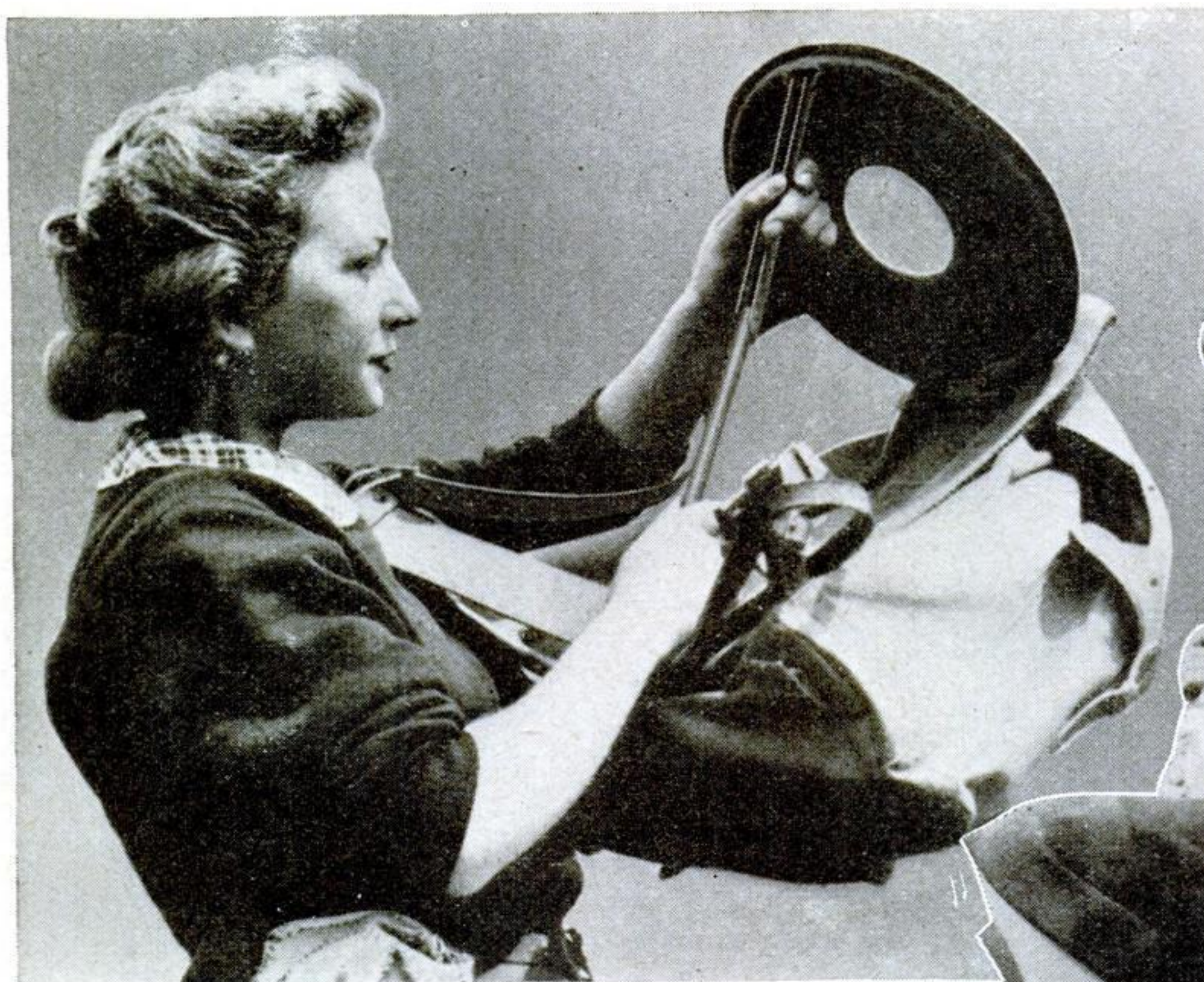
A GLASSLIKE spring of fused quartz, in one of the oddest of spring balances, enables General Electric engineers to solve unusual research problems. For example, the experimenters wanted to weigh the moisture absorbed by cotton from air of varying humidity. The dampness would rust steel springs. Other important tests called for a spring that would weigh less than steel, stretch farther, resist corrosive chemicals better, and remain elastic at higher temperatures. Fused quartz, made by melting crystalline quartz rock, met every need, but how to make it into a spring was a puzzle until the experimenters hit upon the present scheme. Heating the middle of a rod of quartz to 3,000 degrees F. with an oxyhydrogen flame, they suddenly pull it out like molasses taffy into a fifteen-foot filament. Then they wind this quartz thread, softened by three small flames, upon a slowly revolving mandrel of the proper diameter. In the new balance, one of the quartz springs supports the test specimen in a tiny glass dish, within a tube brought to any desired temperature by a surrounding oil bath. As the weight of the sample changes, the spring varies in length.



In this odd spring balance, made to be immersed in a bath of oil, a spring of fused quartz supports the tiny glass dish containing the test specimen. A steel spring could not be employed here



An operator examining the coil of quartz as it is wound on a mandrel. Left, how the quartz filament is warmed by a three-point flame to keep it soft as it winds slowly into the coil



This girl hiker is unfolding an attachment to convert her knapsack into a seat, as illustrated below



Knapsack Has Built-in Seat

A HANDY accessory for hikers, mountain climbers, and sportsmen is a new knapsack that has a seat built into the back. When a hiker becomes tired, he can remove his pack, swing the seat upward to a horizontal position, straighten out a hinged metal supporting rod, and make a comfortable chair out of his knapsack.

Hand Press Shapes Standard-Size Hamburgers



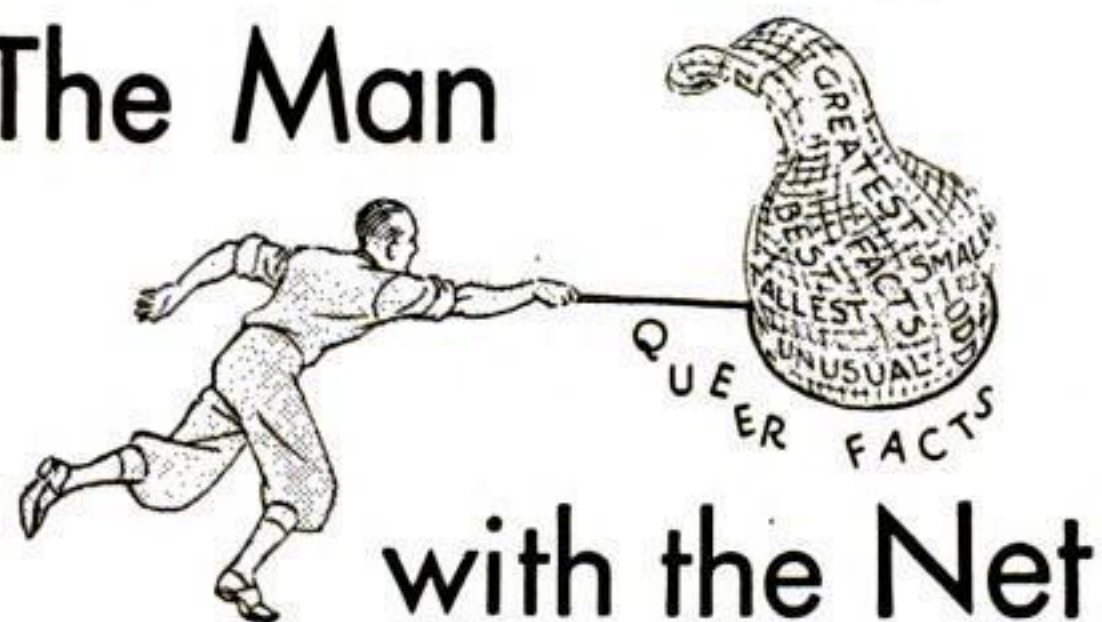
Pressure on the hand lever squeezes meat into a cake

GROUND meat is shaped into cakes of standard size and weight for cooking by a novel hand-operated machine designed by Claude Coseboom of Pasadena, Calif., for use in restaurants and lunch wagons. Mounted on a broad base, a circular metal cup holds a removable aluminum disk containing three slots bordered by small, sharp teeth. Meat incased between layers of waxed paper is placed on the disk and molded to a uniform shape and thickness by forcing down the handle of a press, as shown in the photograph. The teeth in the aluminum disk puncture the waxed paper so that any excess meat can pass out through the slots in the bottom of the press.

Mammoth Preserved in Snow

SNOW packed on a wire network formed a giant refrigerator built on Wrangell Island, in the Arctic Ocean, to preserve the frozen carcass of a prehistoric mammoth recently discovered there. Unusually warm weather threatened to destroy the specimen before a Russian expedition could take charge of it.

The Man



with the Net

QUARTZ crystals in new radio-frequency oscillators vibrate 20,000 times a second.

JEFFERSON Island; in the Gulf of Mexico, is composed almost entirely of pure salt.

DINOSAURS, it is estimated, ate as much as 1,000 pounds of food a day.

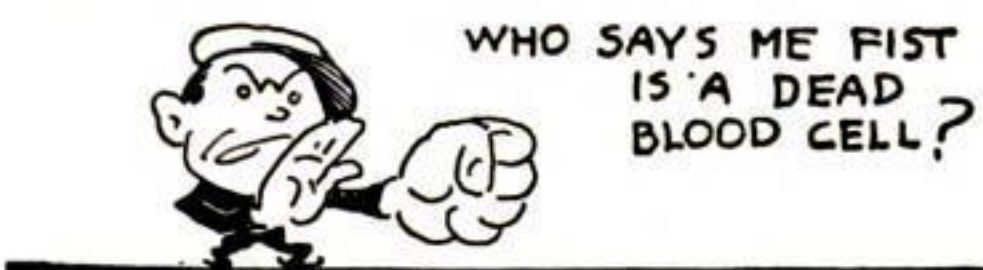
TWENTY-TWO muscles are used by a bee in stinging.



MORE than 29,000 persons have been cured of cancer in the United States alone.

EIGHT out of ten highway motorists are making journeys of twenty miles or less.

BRUISES obtain their black-and-blue coloration from dead blood cells.



EGYPTIANS painted their eyelids green as a protection against the glare of the sun.

INCINERATORS where old money is destroyed at the U.S. Treasury are equipped with time locks so no one can open them before the bills are burned.

ARTIFICIAL rubber obtained from tomatoes has been reported from Italy.

SIX MILLION tons a cubic inch is the estimated weight of the heaviest star in the sky.

6,000,000 TONS,
3½ OUNCES, NOW
PROVE I'M WRONG!

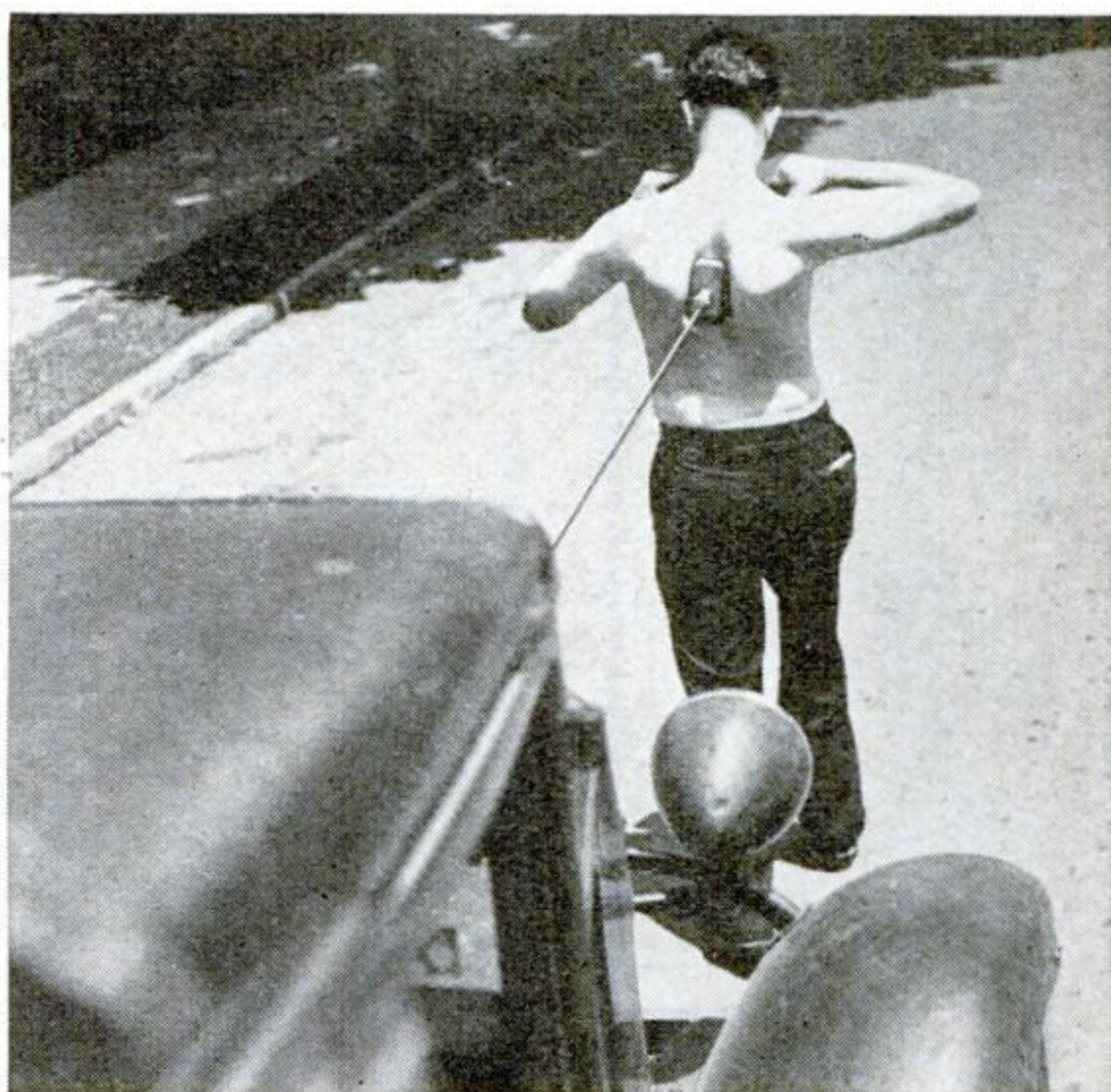


The United States is at your feet, in this striking rug pattern



Novel Playroom Rug Is Map

BORDERED by a colorful design depicting the development of transportation, a novel felt-base rug just marketed for use in children's playrooms is decorated with a large map of the United States, on which states, rivers, principal cities, and main resources are marked.



Shoulder Blades Pull Truck

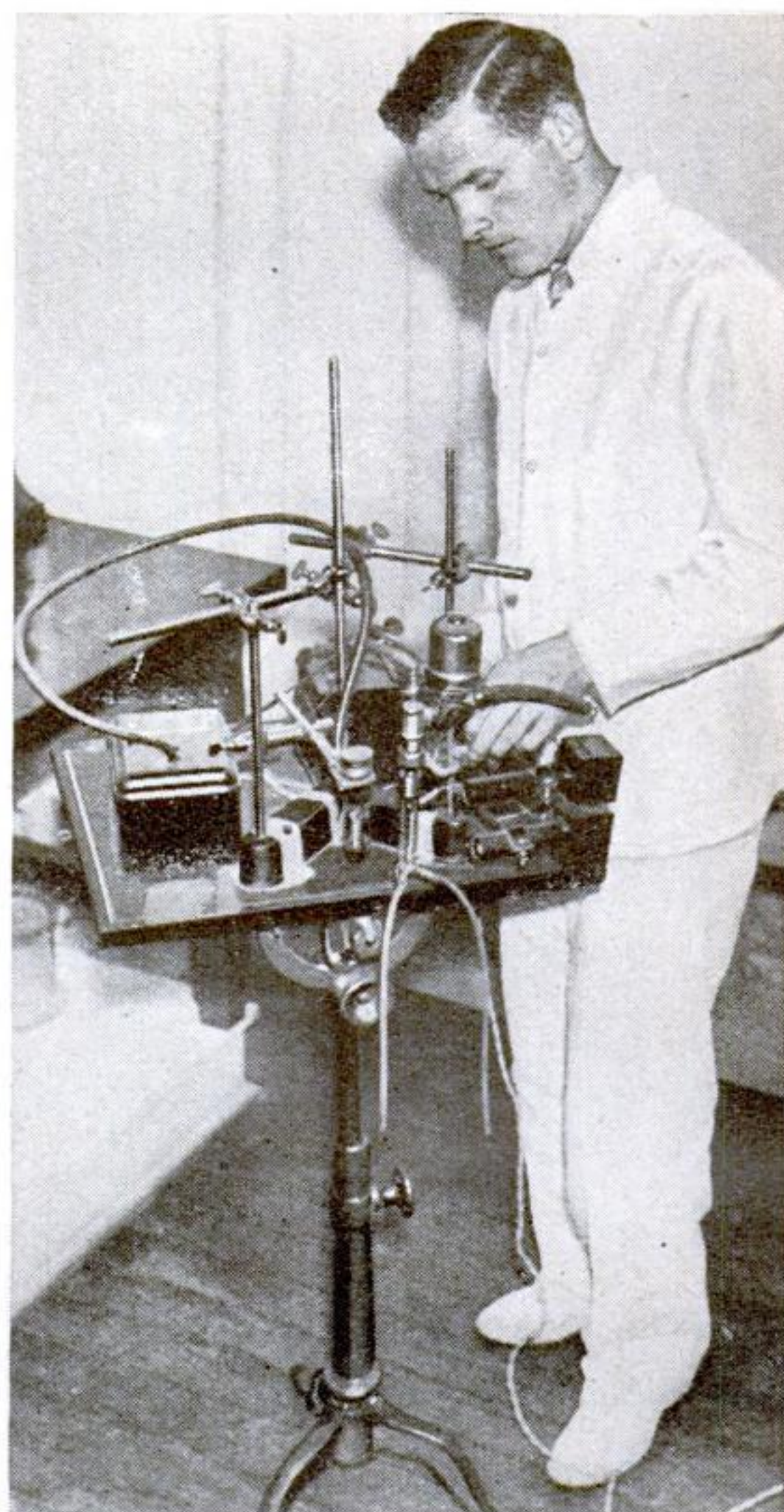
POWERFUL back muscles and exceptional muscular control enable Lawrence Anderson of St. Louis, Mo., to pull a two-ton truck by means of a rope fastened to a wood block which he grips between his shoulder blades, as shown above.

Electric Eye Runs Glass Heart

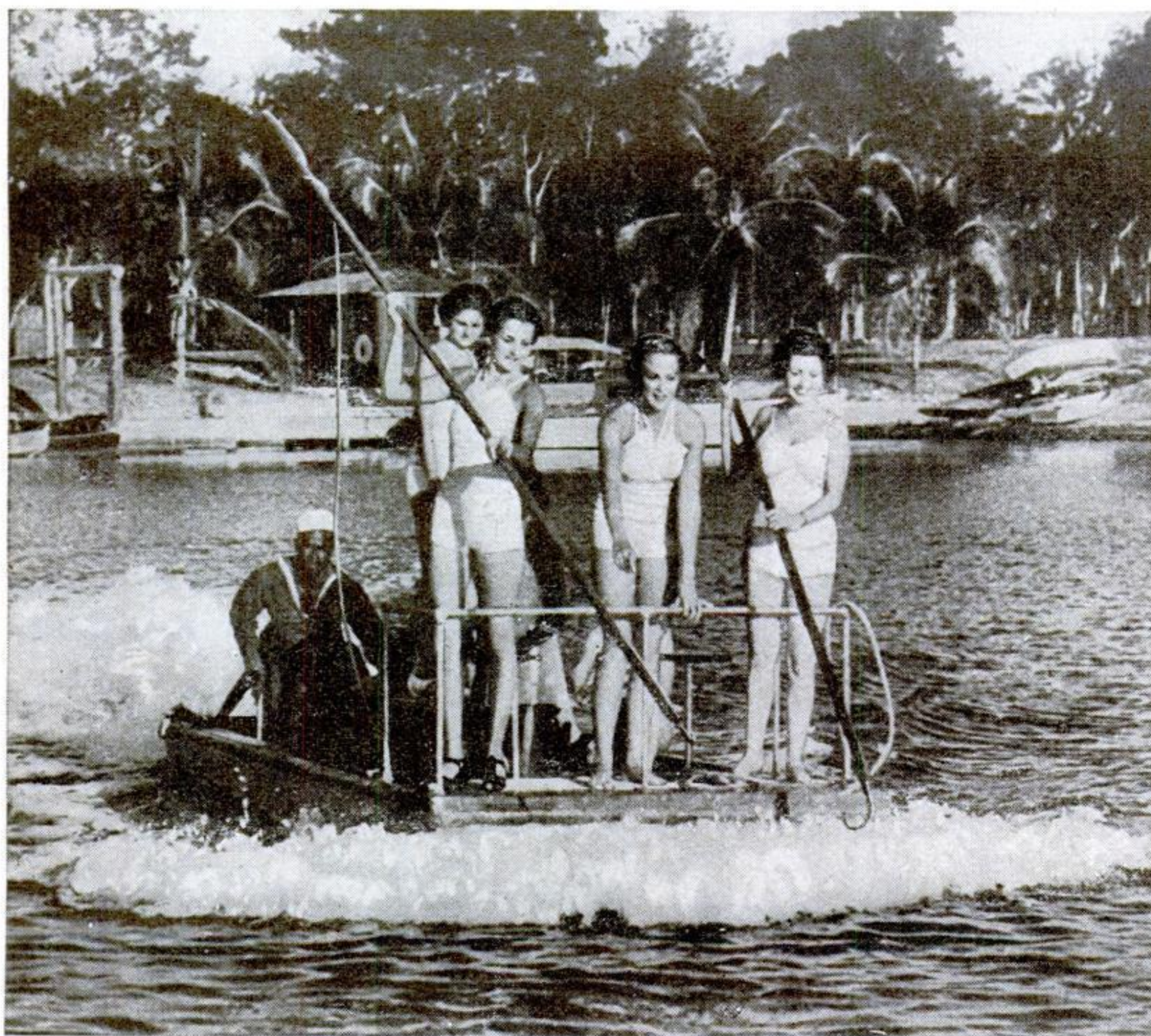
A PHOTO-ELECTRIC cell, or electric eye, controls the operation of a new type of artificial heart designed for research experimentation by Dr. Gerhard Katz at the Tulane University Medical School, New Orleans, La. As blood, forced through the apparatus by compressed air, pulses through a glass tube that forms the heart, it intermittently interrupts beams of light directed at the photo-electric cell, which in turn activates an electric valve controlling the flow of air pressure. Action may be speeded or slowed at will.

Child's Chair Won't Slip or Tip

MADE for children who have outgrown their high chairs, a "junior" chair recently introduced has feet fitted with rubber suction cups so that it may be fastened firmly to a large chair, an automobile seat, or the floor. Secured by suction, the child's chair will not tip, slip, or mar the finish on which it rests. A special attachment is provided for use in a car.



Controlled by beams of light, this mechanical heart has no moving parts



Being flat-bottomed, the boat can navigate shallow bays in search of fish

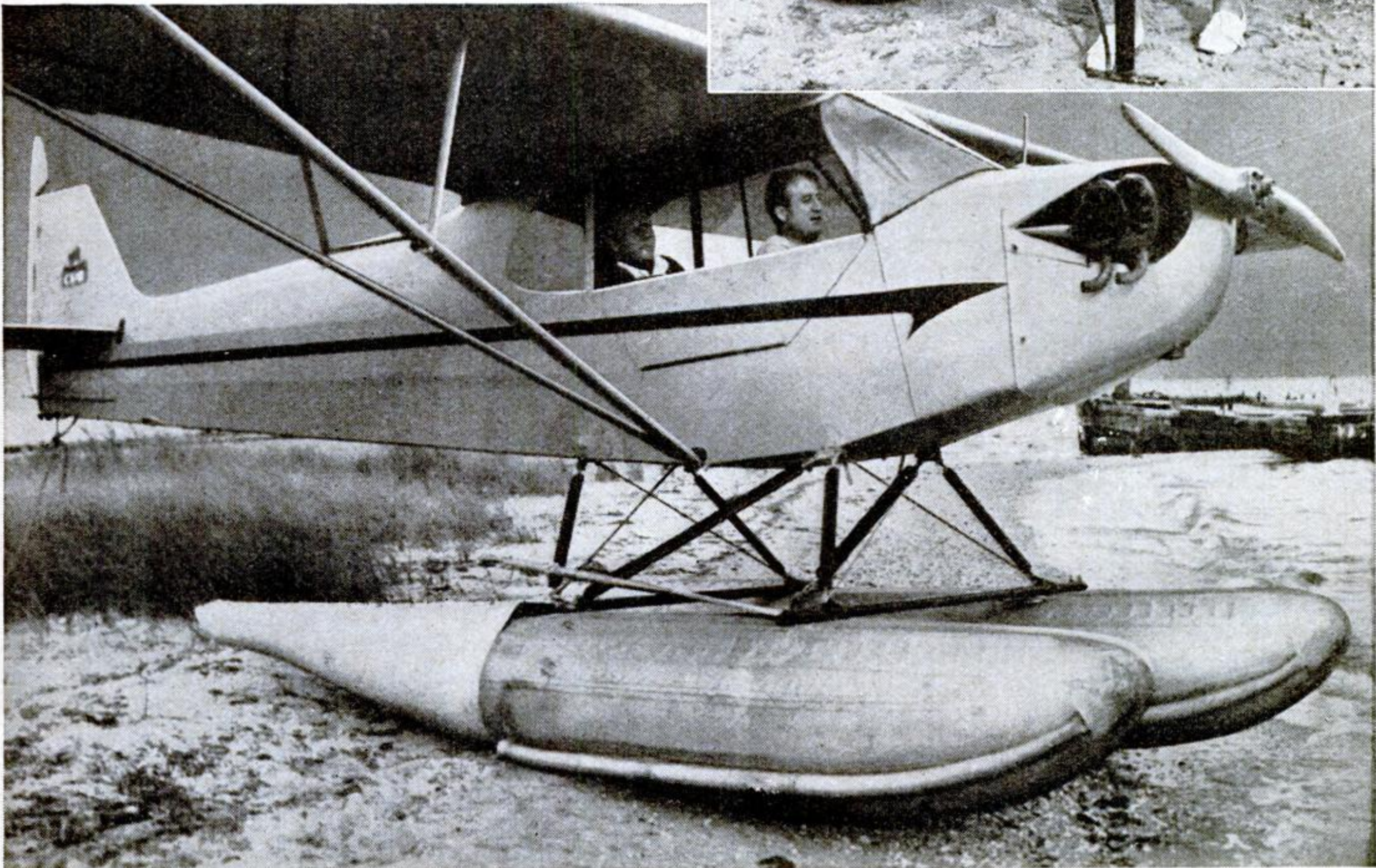
Harpooners Hunt Fish in Odd Boat

FISH are harpooned from a novel power barge used to negotiate the shallow waters of bays and inlets off the coast of Florida. Powered by an outboard motor, the unusual craft has a raised platform at the front, where fishermen, steadied by a metal railing, poise their harpoons for a lunge at their game. The barge is called a "prowler" because of its occasional nighttime voyages into narrow inlets in search of giant rays.

Rubber Seaplane Pontoons Act as Shock Absorbers

SEAPLANE pontoons invented by Capt. Ashley C. McKinley, former U. S. Army flyer, are made of rubber instead of the usual metal or wood. Inflated with air to a maximum pressure of three pounds to the square inch, the pontoons are much lighter in weight than other types. According to the inventor, they act as shock absorbers when the plane is alighting or taking off from the water and serve as bumpers if it hits a dock or drifting object.

Rubber pontoons being inflated with automobile-tire pump



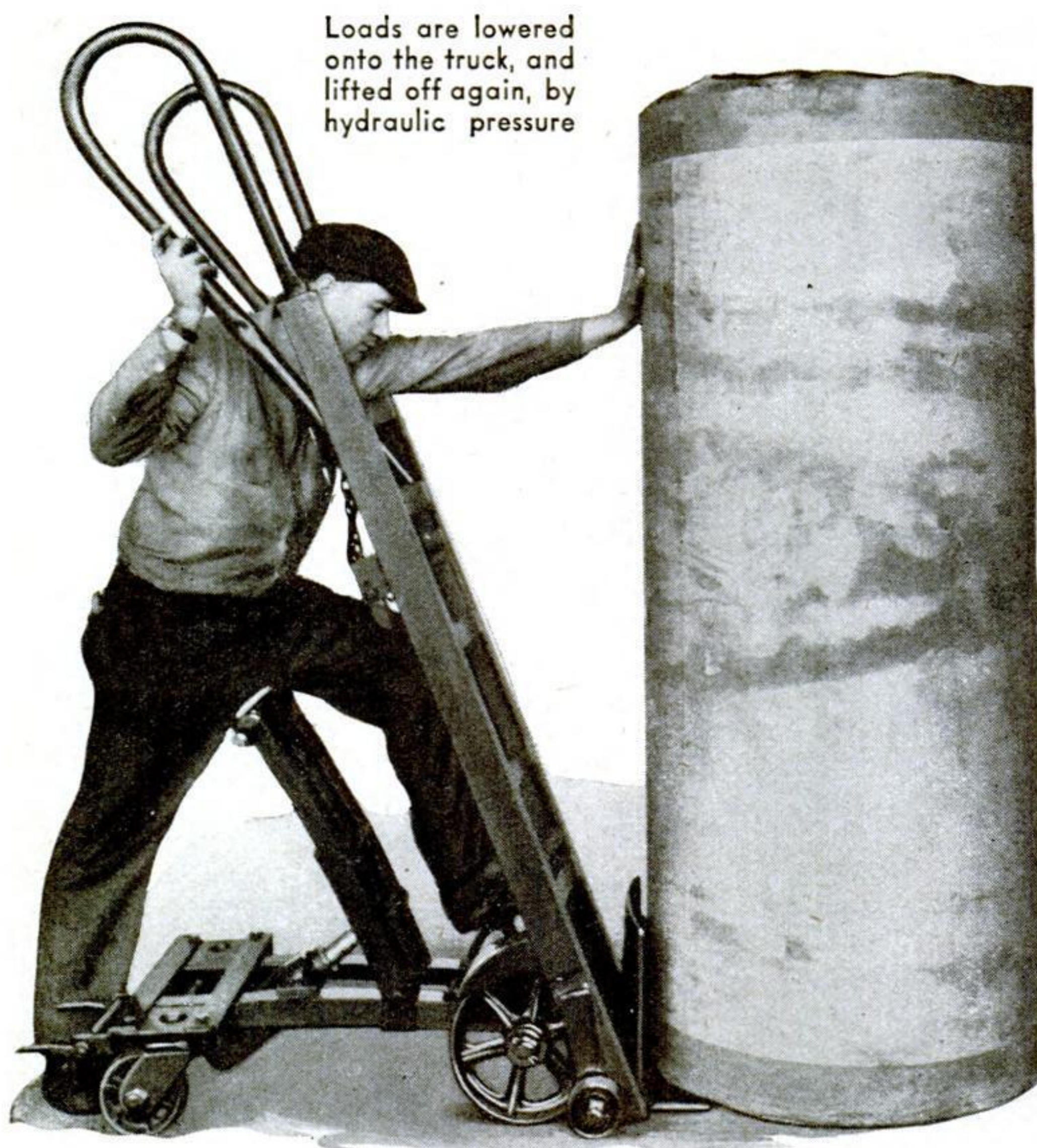
A small seaplane fitted with the novel floats. They can be made in sizes to support all types of craft



A removable sheet of glass protects the photograph

Book Ends Do Double Duty as Frames for Pictures

BOOK END and picture frame are combined in one novel unit that has recently been put on the market. Made in either ivory or gold finish, the unit includes a sheet of clear glass to protect the photograph inserted in the frame. The glass is easily removed by pushing it upward with the fingers and then grasping the bottom edge as it rises from the slot in which it rests. The photograph is removed in the same manner. A weighted base holds the book end in place.



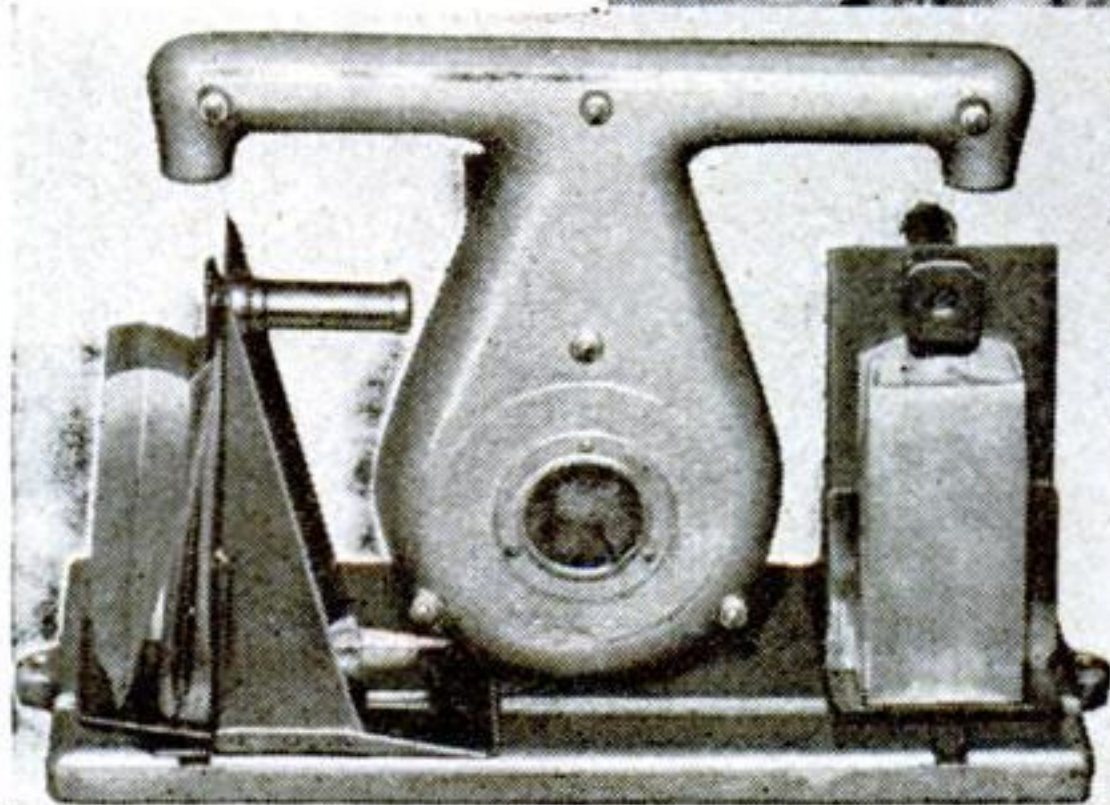
Loads are lowered onto the truck, and lifted off again, by hydraulic pressure

1,500-Pound Loads Carried on Hand Truck

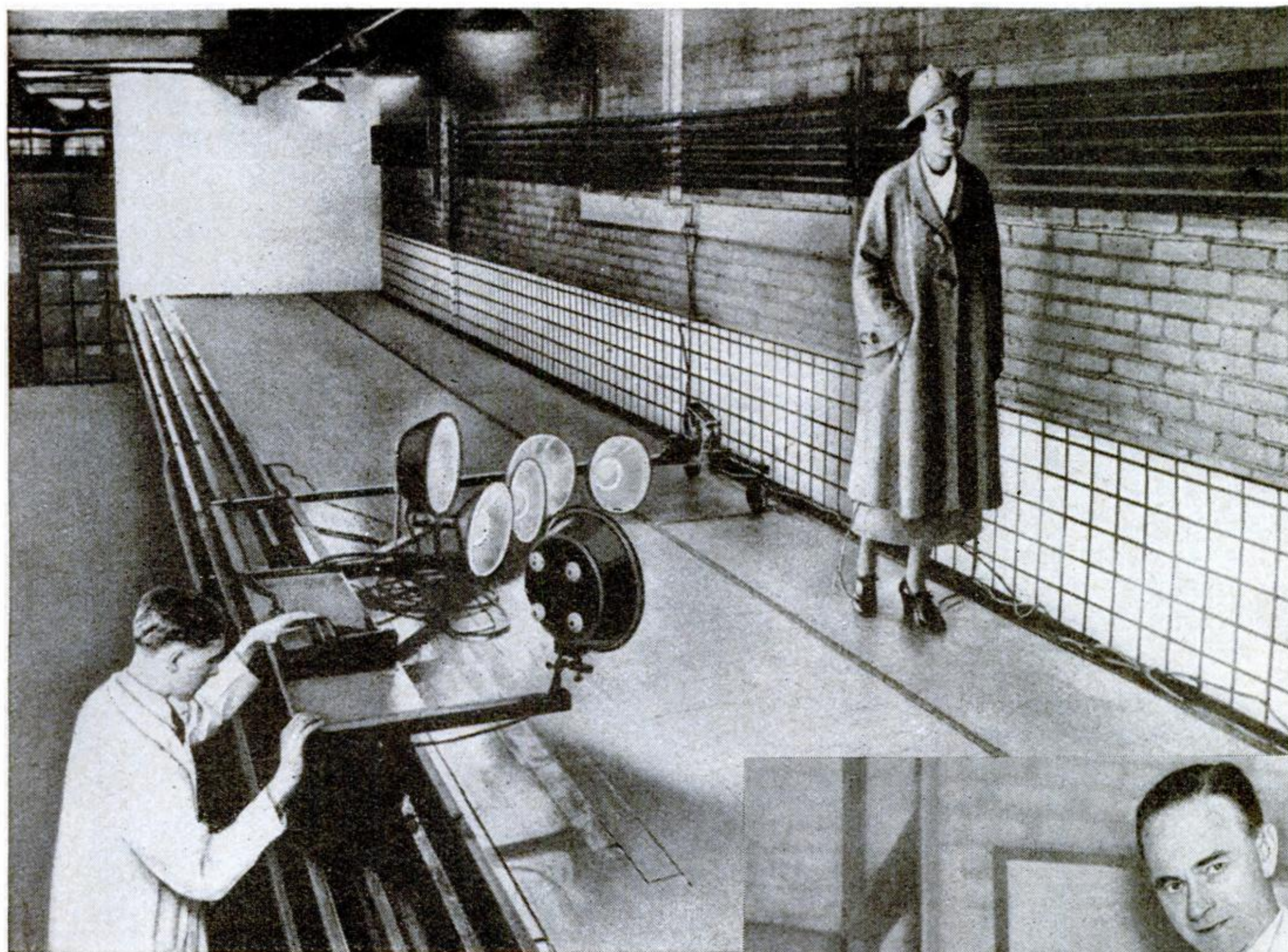
WITH a scientifically designed hand truck, one workman can handle loads up to three-quarters of a ton in weight. The novel feature of the carrier is a hydraulic-jack support which lowers the burden to any desired angle. The operator, by means of a foot pedal, stops the load at the angle at which pushing it can be accomplished best. When it has reached its destination, the burden is raised hydraulically to an upright position. Thus heavy and awkward objects can be moved from one part of a factory to another with ease. The truck is particularly valuable in newspaper plants.

Air Blows Bags Open for Packing Ice-Cream Bars

POWERED by a small electric motor, a novel air-blast machine opens transparent bags in which ice cream sticks, bars, and other confection novelties are wrapped. Eliminating the task of flipping the containers open by hand, the machine is equipped with two air outlets so that two operators can use the device at the same time. A continuous blast of air, produced by an electrically driven fan, pours out of each outlet to blow open the containers that are fed into the air stream from adjustable springs clips holding 100 bags of any size up to seven inches in length. Made of aluminum and steel, the bag opener weighs seventy-five pounds and in recent tests performed as much work as four men opening the containers by hand. The machine is shown in use at the right.

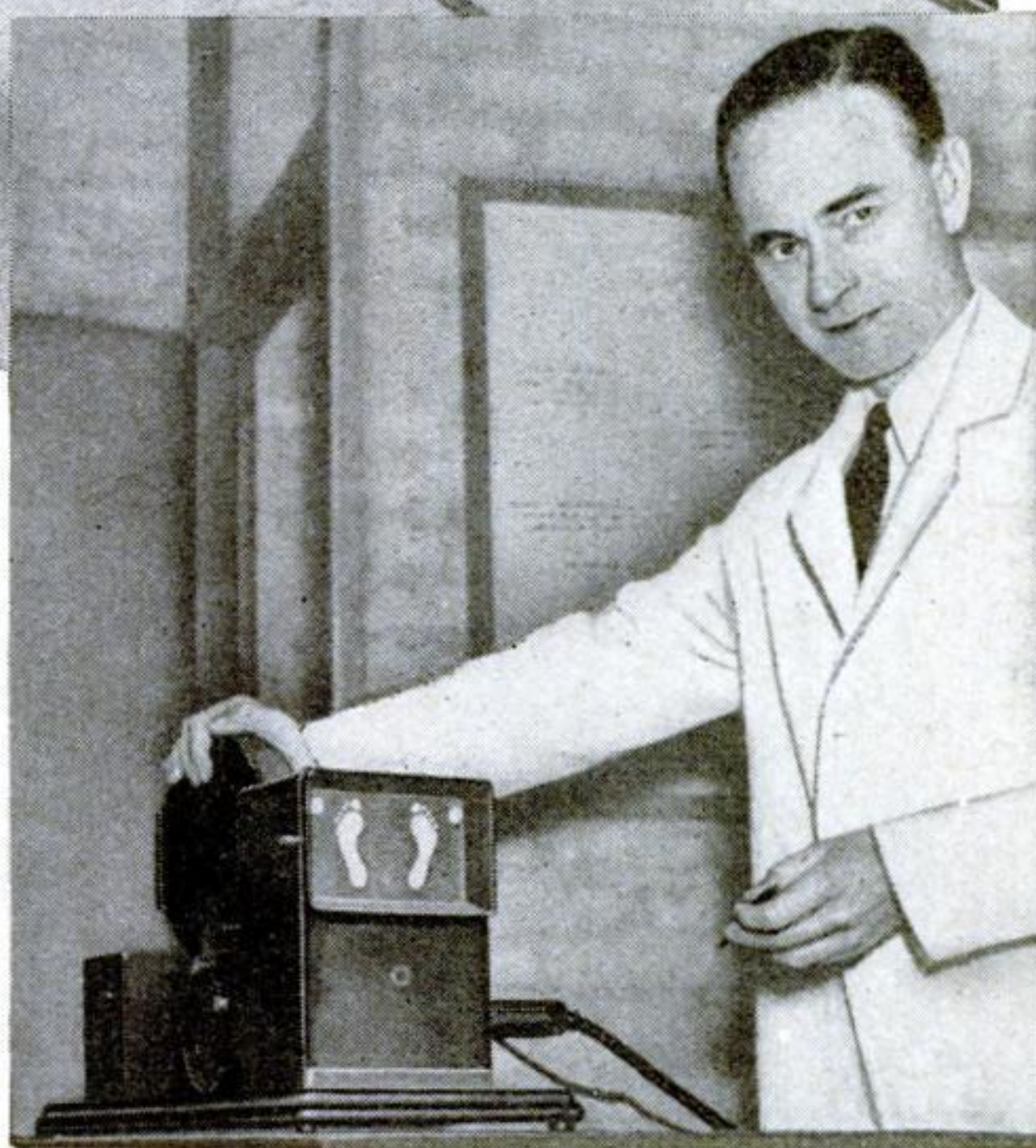


Workers inserting ice-cream bars in bags blown open by air. Left, close-up of the fan-operated machine that does away with inefficient hand opening of containers

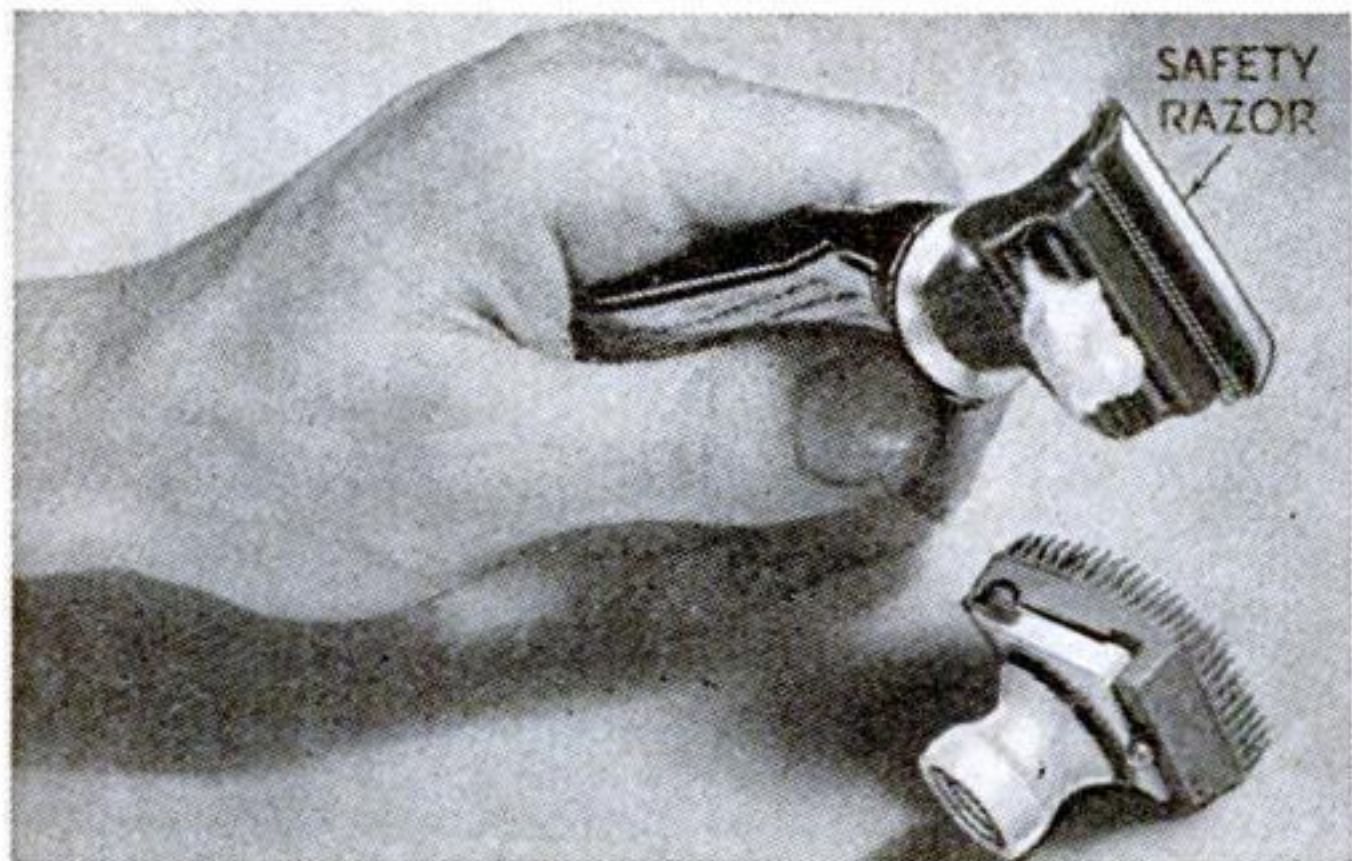


Walk-Testing Laboratory Checks Shoe Designs

ELECTRICAL contacts and high-speed motion picture cameras are being used by Dr. R. Plato Schwartz, of the University of Rochester, N.Y., to study the effect that various types of shoes have on the way we walk. With tiny metal disks attached to their shoes, subjects walk along a metal floor. Each time a disk touches, a light flashes on to record the duration of the contact in an apparatus called an "electrobasograph." At the same time, movie cameras are recording from sixty to 110 pictures a second for study in conjunction with the electrically made record.



Dr. R. Plato Schwartz with the instrument that records contacts of the feet with a metal floor in tests like the one seen in upper photograph



As the tube is squeezed, cream comes out a slot

Razor Spreads Shaving Cream

COMBINING a safety razor and an applicator for brushless shaving cream, a new accessory for men simplifies shaving. The tube of cream is screwed into the head of the device. Squeezing the tube forces the cream out through a narrow opening on one side of the head so it can be spread evenly over the beard. The combination device is then turned over and used as a safety razor, the tube acting as the handle. Another type of applicator is equipped with a rubber "brush" for use with lather-producing creams.

DARE-DEVIL DRIVERS STRIVE FOR *750 Miles an Hour*

AT BONNEVILLE FLATS, in Utah, this year, three of the world's greatest racing drivers will hurl roaring bullets on wheels down a straight black line stretching for thirteen miles across glittering, hard-packed salt. Capt. George Eyston, who last November rocketed to a world speed mark; John Cobb, a fellow Englishman with a string of records to his credit; and the famous American driver, Ab. Jenkins, all are bringing secretly built, superspeed machines to the dry lake bed close to Salt Lake City.

It was on this natural speedway, in 1935, that Sir Malcolm Campbell's *Bluebird* first passed the 300-mile-an-hour mark. In a hair-raising exhibi-

tion of driving skill, the fifty-year-old speed king brought his six-ton machine safely to a halt after a front tire had burst as he was slowing down but still ripping across the salt flats at more than 250 miles an hour. Two years later, on the same straightaway, Eyston's seven-ton *Thunderbolt* lifted the world mark to 311.42 miles an hour.

This year, the redesigned *Thunderbolt* is expected to reach 350 miles an hour. The next goal is 400 miles an hour and the ultimate speed which motor men of today have set as

By
ART WRIGHT

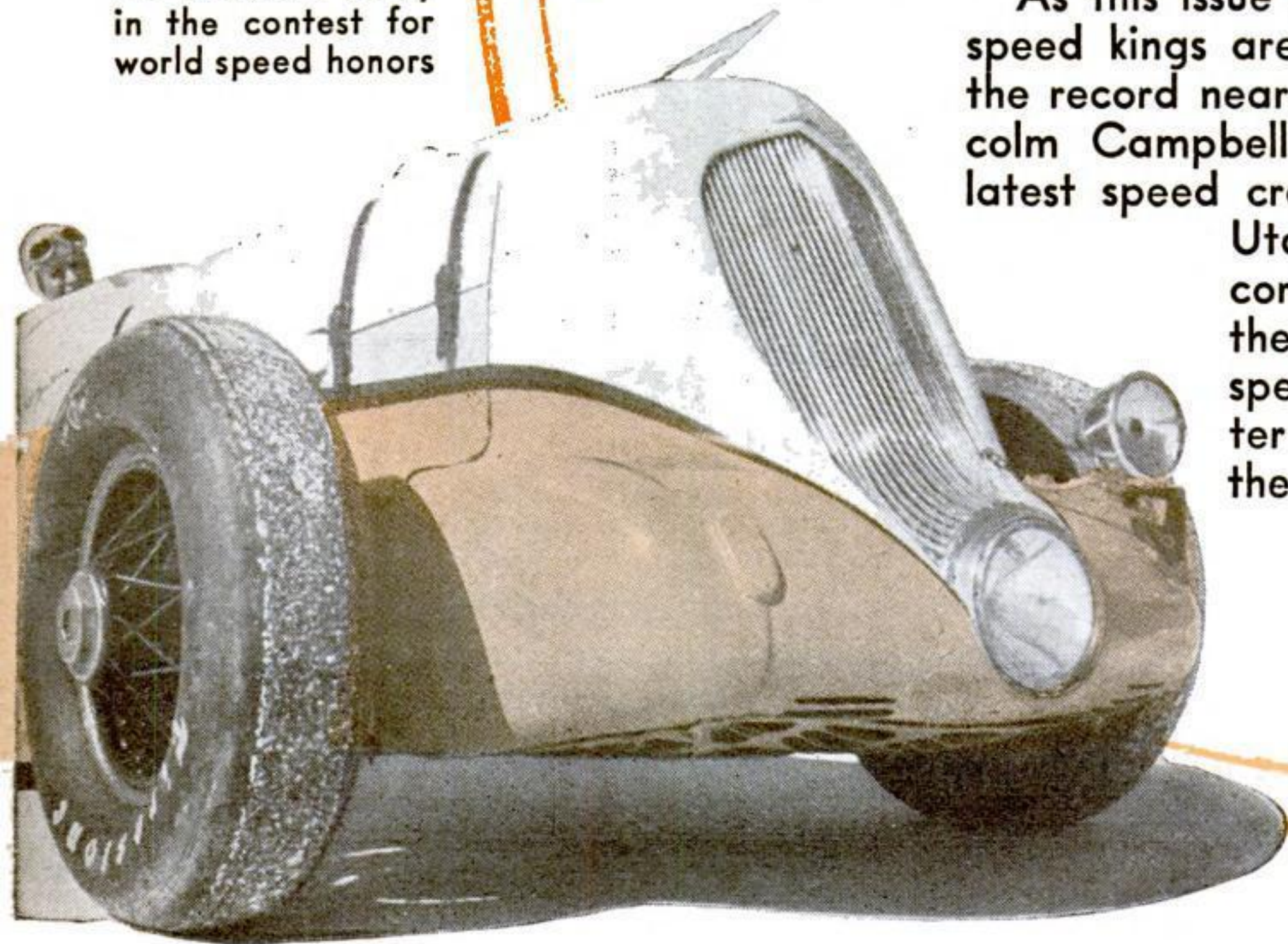
The streamline prow of Ab. Jenkins's "Mormon Meteor" has cut the air to carry the American ace driver to more than 100 endurance marks. This car, it is said, is serving as a model for Jenkins's entry in the contest for world speed honors



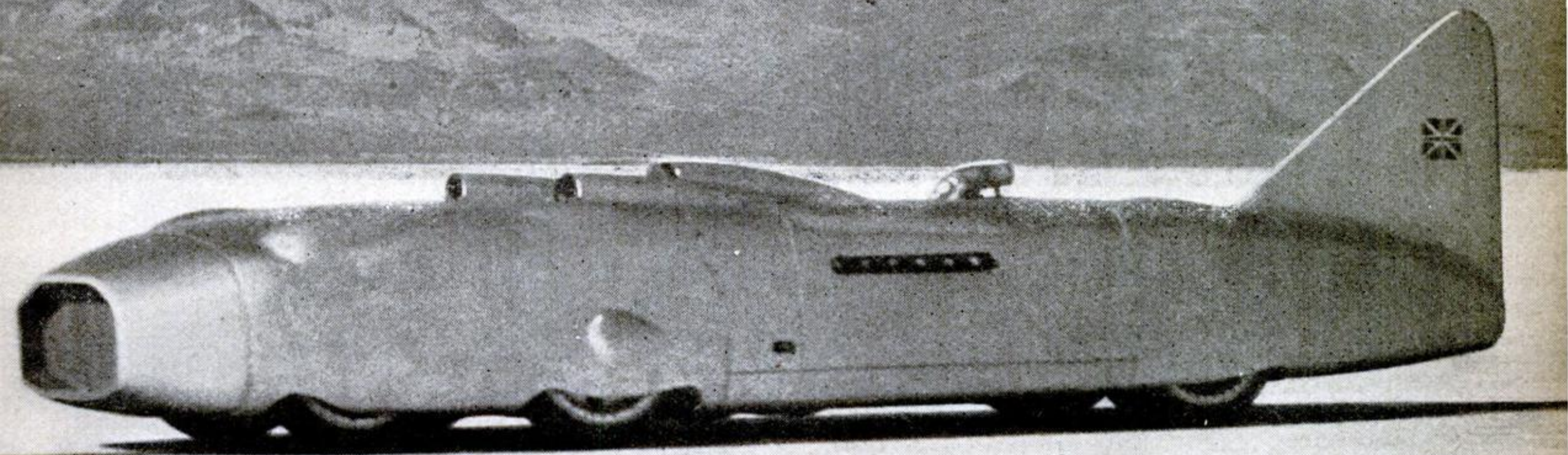
FASTER THAN SOUND

What will be the greatest speed man will ever attain on land? From the four super-speed experts—John Cobb, Ab. Jenkins, Captain George E. T. Eyston, and Sir Malcolm Campbell—comes the unanimous answer, "there is no limit." They believe that 750 miles an hour, faster than the speed of sound, should be entirely possible.

As this issue goes to press, three of these speed kings are slated to attempt to boost the record nearer this goal. All but Sir Malcolm Campbell are scheduled to try their latest speed creations on the open flats of Utah's Bonneville Salt Beds. According to the experts, one of these three should succeed in speeding across the plains at better than 350 miles an hour—with the 400 mark a possibility in 1939.



n an Automobile



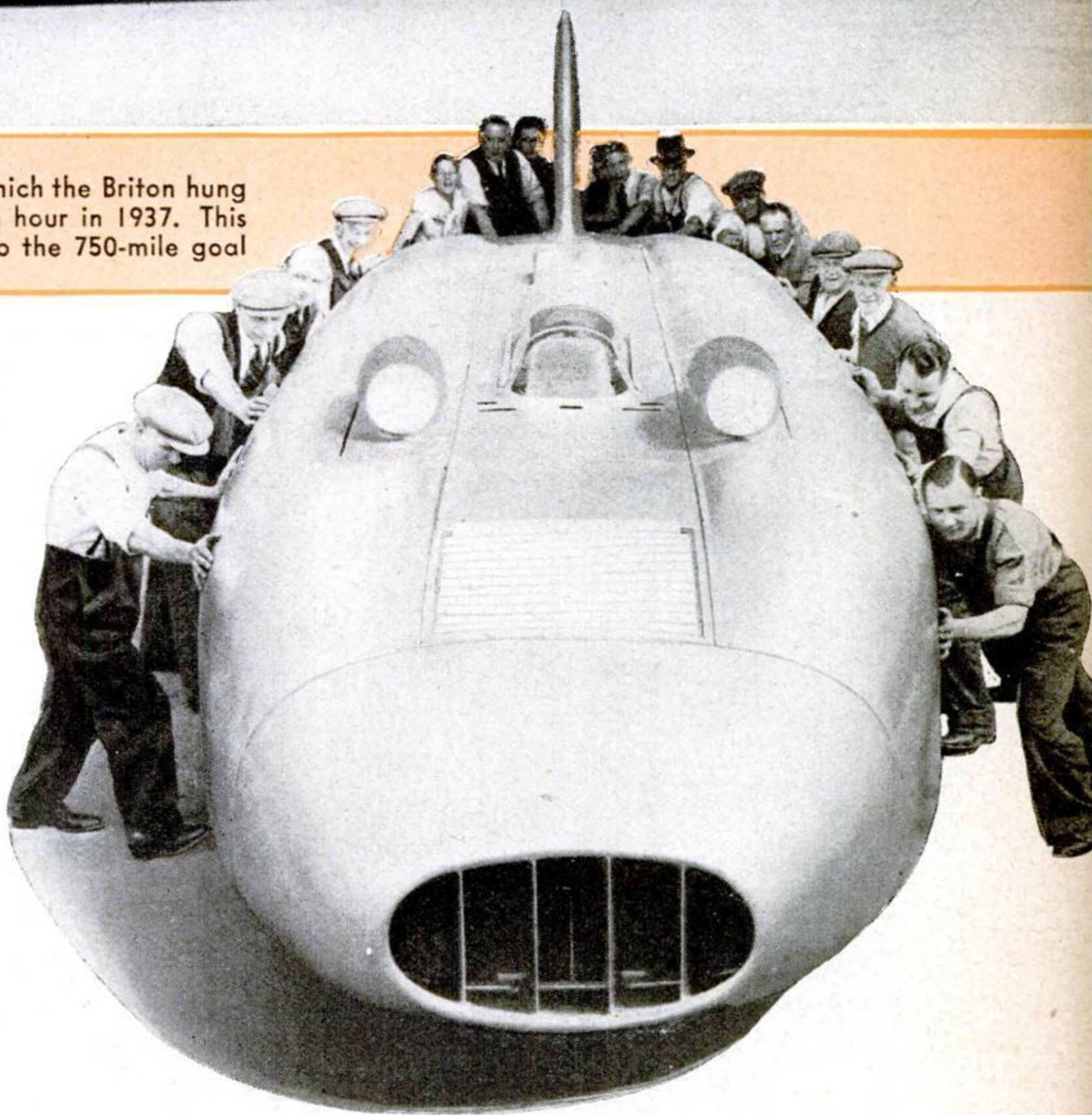
Capt. George Eyston's "Thunderbolt," in which the Briton hung up a land-speed record of 311.42 miles an hour in 1937. This year, he hopes to boost the mark nearer to the 750-mile goal

their mark is twelve miles a minute, 750 miles an hour—a pace faster than the speed of sound!

Will drivers ever attain this goal? Will men and metal be able to endure the tremendous strains of such a pace? In a word, is the goal a fantastic dream or is it within reach of scientific advance?

Campbell, Eyston, Cobb, Jenkins—the men who have penetrated farthest into the dangerous realms of super-speed—all believe that some day such a pace will be attained. Reid A. Railston, the British engineering genius who built Campbell's *Bluebird* and recently tuned up his latest creation, Cobb's twin-motored machine, agrees.

When this mark is reached, and some driver of the future flashes over a measured mile in five seconds, what sort of a machine will he steer? Will it be a ponderous giant battering its way through tremendous air pressures by brute force, or will it be some powerful midget



car screeching along close to the ground? This is the big question designers are debating today.

Campbell's record-smashing *Bluebird* was more than twenty-eight feet long and Eyston's twenty-four-cylinder *Thunderbolt* tips

the scales at seven tons. The driver describes this metal monster as "the craziest car ever built." And, recently, Campbell declared: "I am of the opinion that the future record-breaking car will be built much lighter than the existing holder of the title." Most experts agree. The trend seems to be toward smaller, more compact entries for the superspeed crown.

The new machines constructed for Cobb

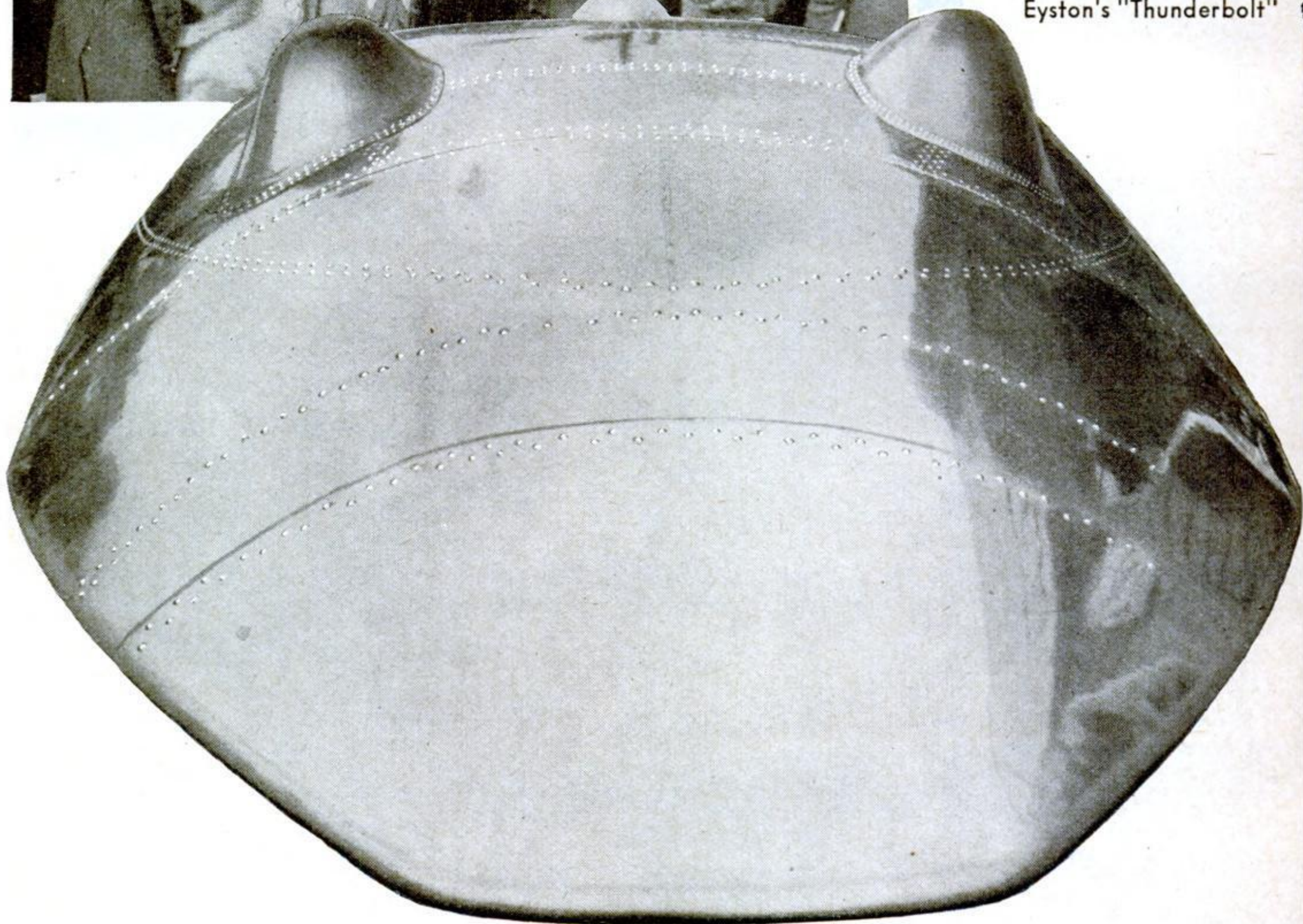
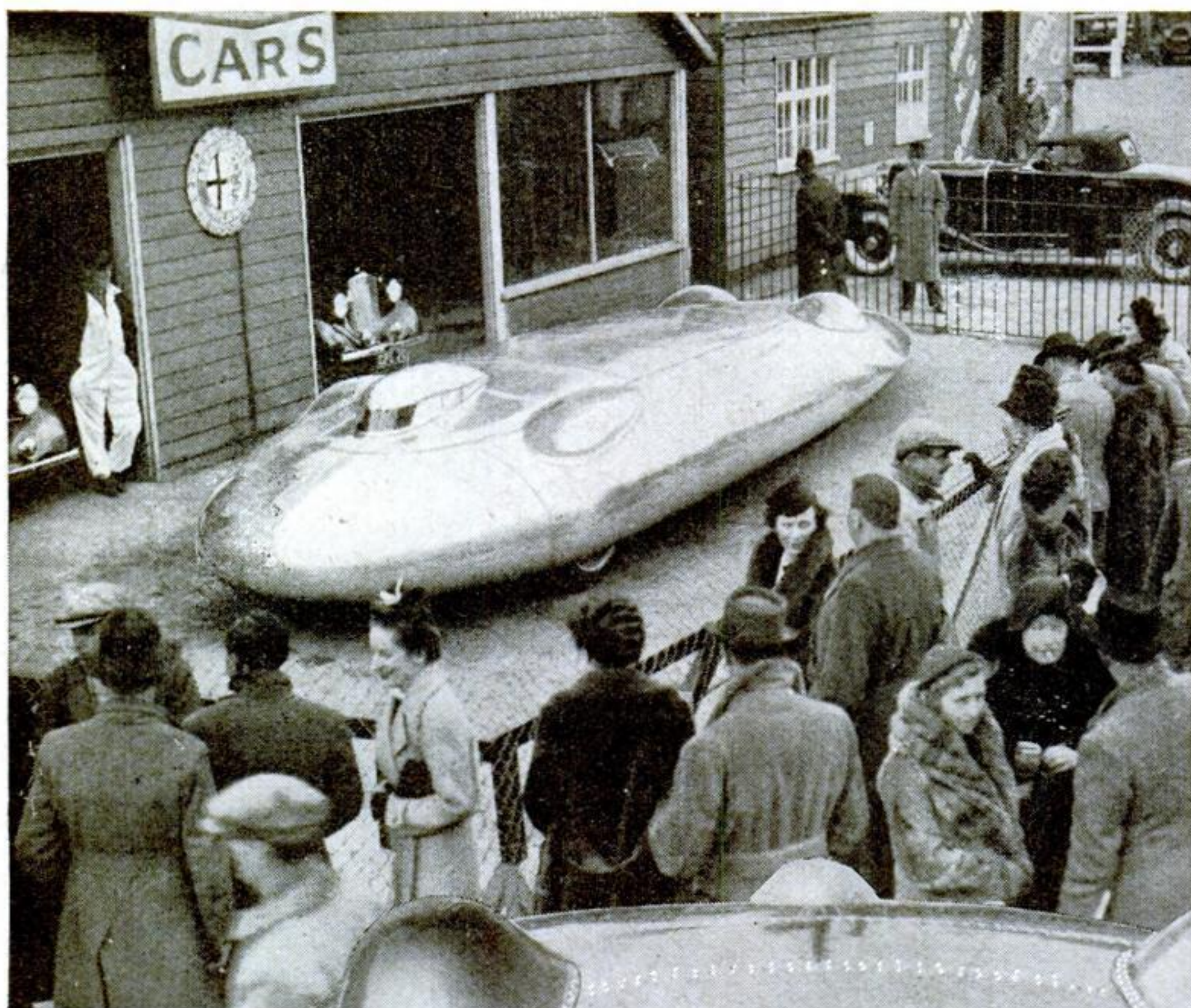
and Jenkins are both much smaller than the 3,250-horsepower *Thunderbolt* which Eyston is driving again this year. Because such machines represent an investment of \$100,000 or more, the details of their construction are carefully guarded secrets.

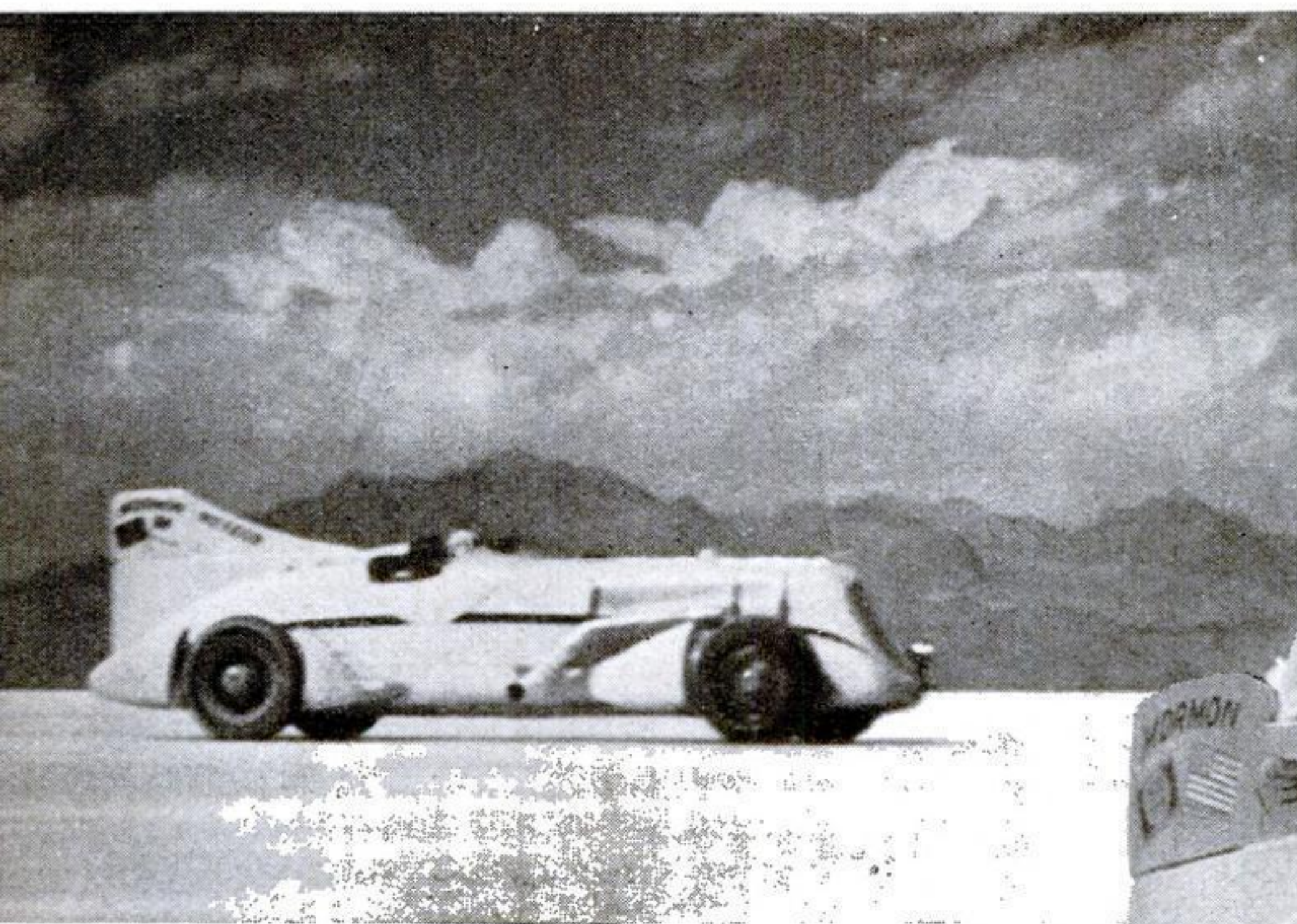
However, some months ago, Cobb told the writer that his car would be a twin-motored vehicle with a streamline turtle-shaped body. Two Napier engines, totaling 2,500 horse-

power, will drive it. This total is 750 short of that of Eyston's Rolls Royce power plants.

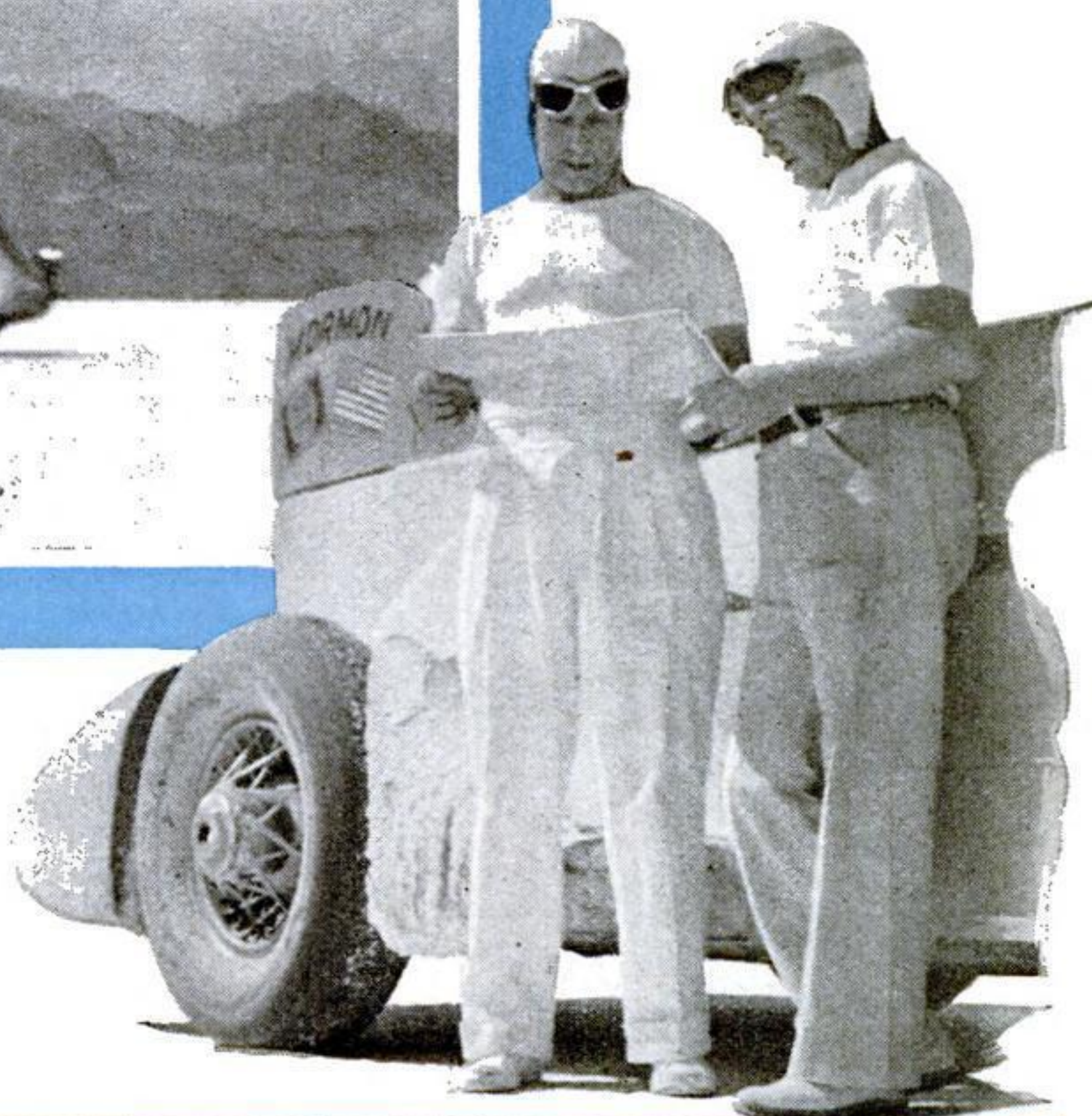
True to the creed of the speed fraternity—that each new racer will test some development for the advancement of everyday motoring—Cobb is

In this odd "turtle car," John Cobb, also an Englishman, may take the world's speed laurels away from his fellow countryman. It is a smaller car than Eyston's "Thunderbolt"





"Mormon Meteor" flashing by in a long-distance run. Below, Ab. Jenkins and Babe Stapp, his relief driver, studying a course charted on a map

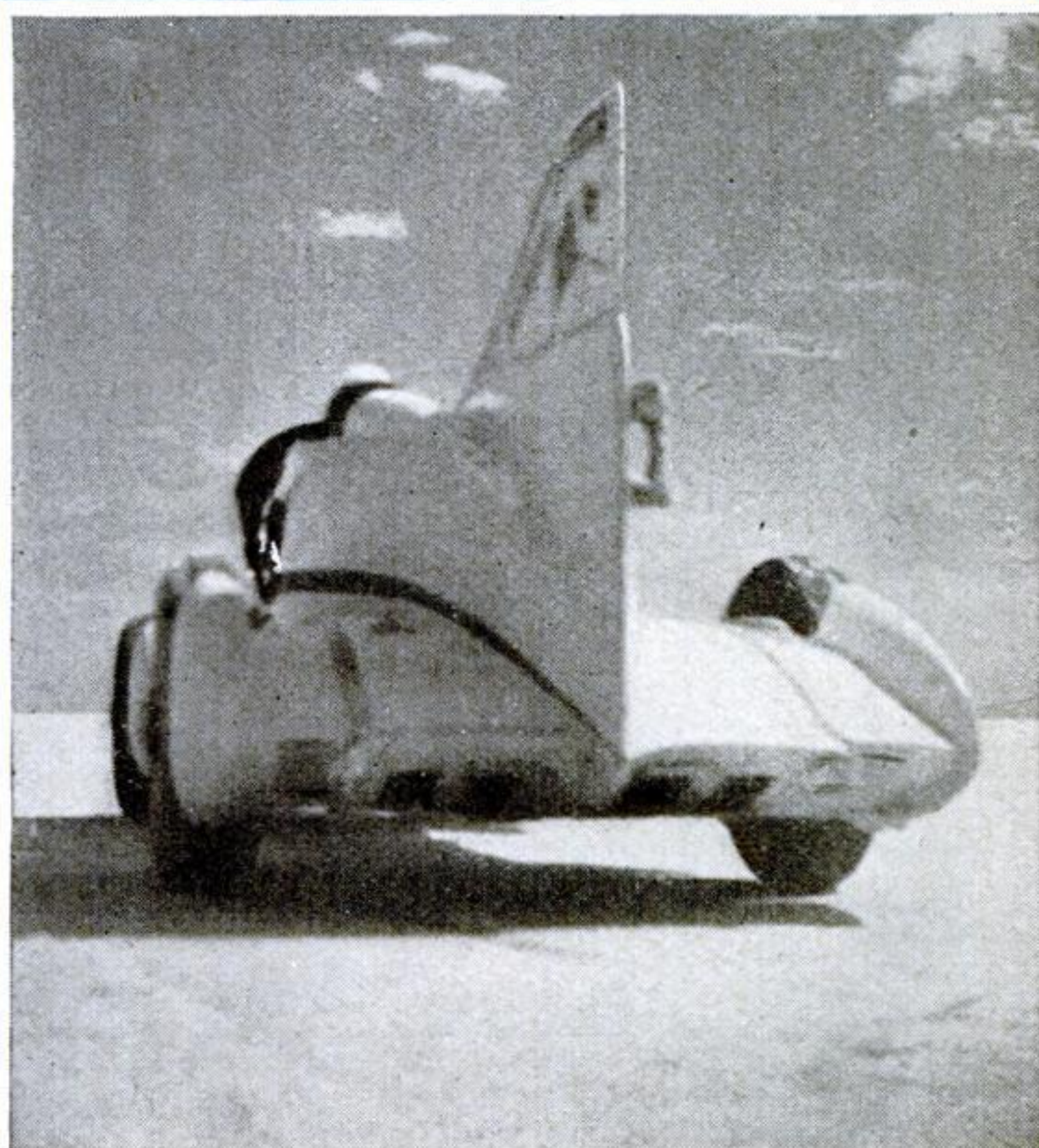


using a four-wheel drive. Campbell's *Bluebird* ran along on six wheels. Eyston's *Thunderbolt* uses eight. Cobb's new machine has only four. But all aid in driving the car forward. One Napier engine is coupled to the rear pair of wheels, the other to the front pair.

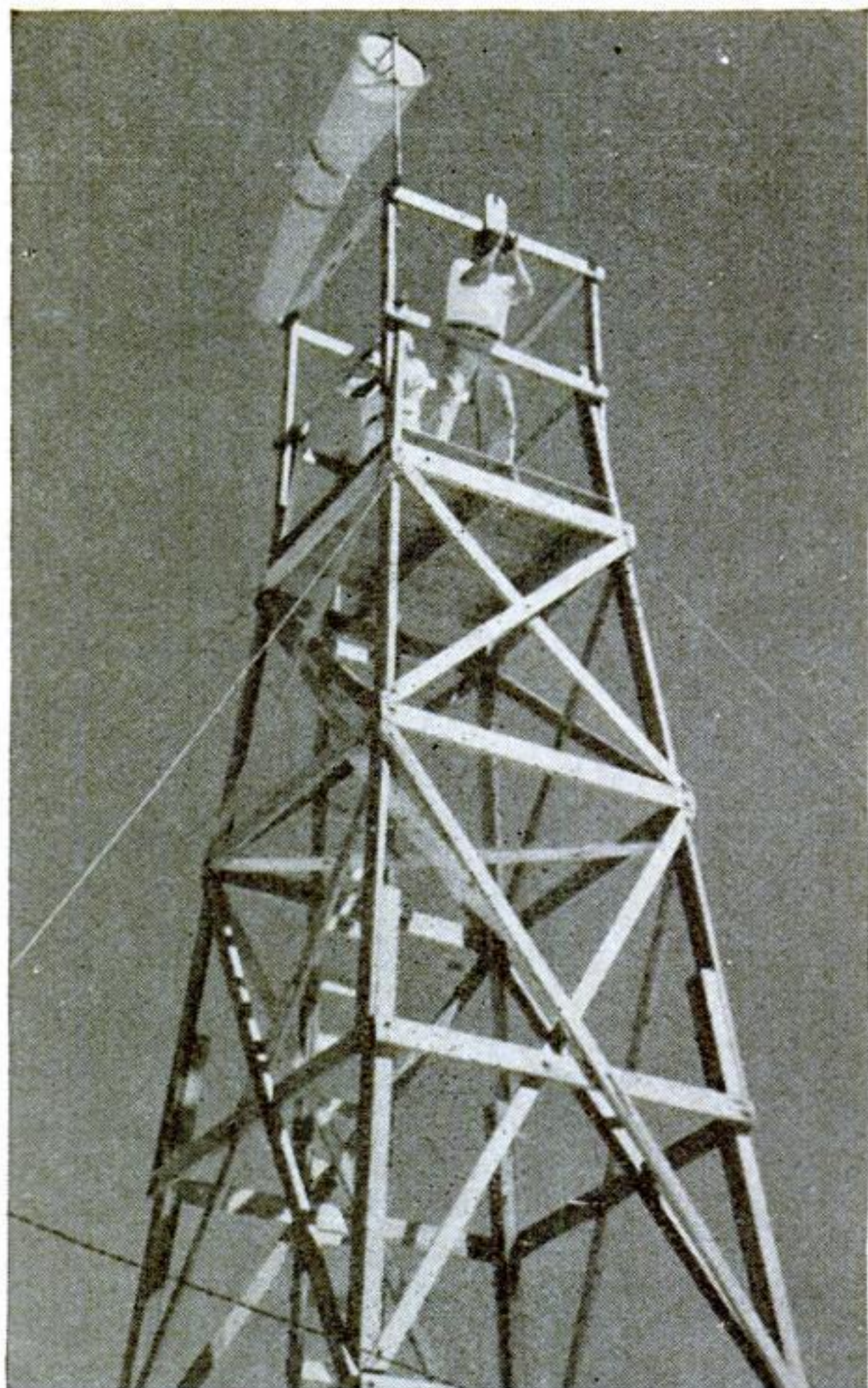
The American entrant for world speed honors, Ab. Jenkins, has had his racer under construction for almost two years. In a remote garage, the whereabouts of which have been kept secret, it has been assembled behind closed doors. This much, however, the writer has learned about Jenkins' activity: He has been successful in obtaining help from the Government in the form of one of the experimental high-speed airplane engines which the U. S. Army has been testing.

The machine Jenkins will drive will be patterned after his famous *Mormon Meteor*, the machine with which he set a string of endurance-speed records at Bonneville in 1936 and 1937. When his latest racer rolls out on the packed salt of the flats, it will be the first American superspeed entry since 1929. In that year, a novice driver, Lee Bible, while attempting to beat Sir Henry Sea-grave's 231-mile-an-hour record, lost control of his *White Triplex*, powered with three Liberty motors. The machine ran amuck, smashed itself into a mass of wreckage, and killed Bible and a newsreel cameraman.

That accident occurred at Daytona Beach, Fla. This ten-mile strip of tawny sand formed the world's premier



Rolling out onto the level expanse of Bonneville Salt Flats—after another endurance record. In this rear view, the "Mormon Meteor" resembles an airplane fuselage



speedway for more than thirty years. It was at Daytona, in 1903, that Alexander Winton took his first crack at the one-mile record, covering the distance at the rate of sixty-eight miles an hour. From then on, Daytona Beach was the center of super-speed activity. It was there that Tommy Milton reached 156 miles an hour in 1920; that Sir Henry Seagrave rode in his *Golden Arrow* at 231 miles an hour in 1929; that Sir Malcolm Campbell reached 245 in 1931, 253 in 1932, 272 in 1933, and, finally, 276 in 1935.

By that time, superspeed cars had outgrown the Daytona strip. They needed more room to come to a stop after their thundering assaults upon the record. While the maximum run on the Florida beach is about ten miles, a thirteen-mile straightaway is provided by the dry lake bed at Bonneville. Here the coarse salt, left behind when the water dried up, is packed until it forms a smooth surface almost as hard as ice.

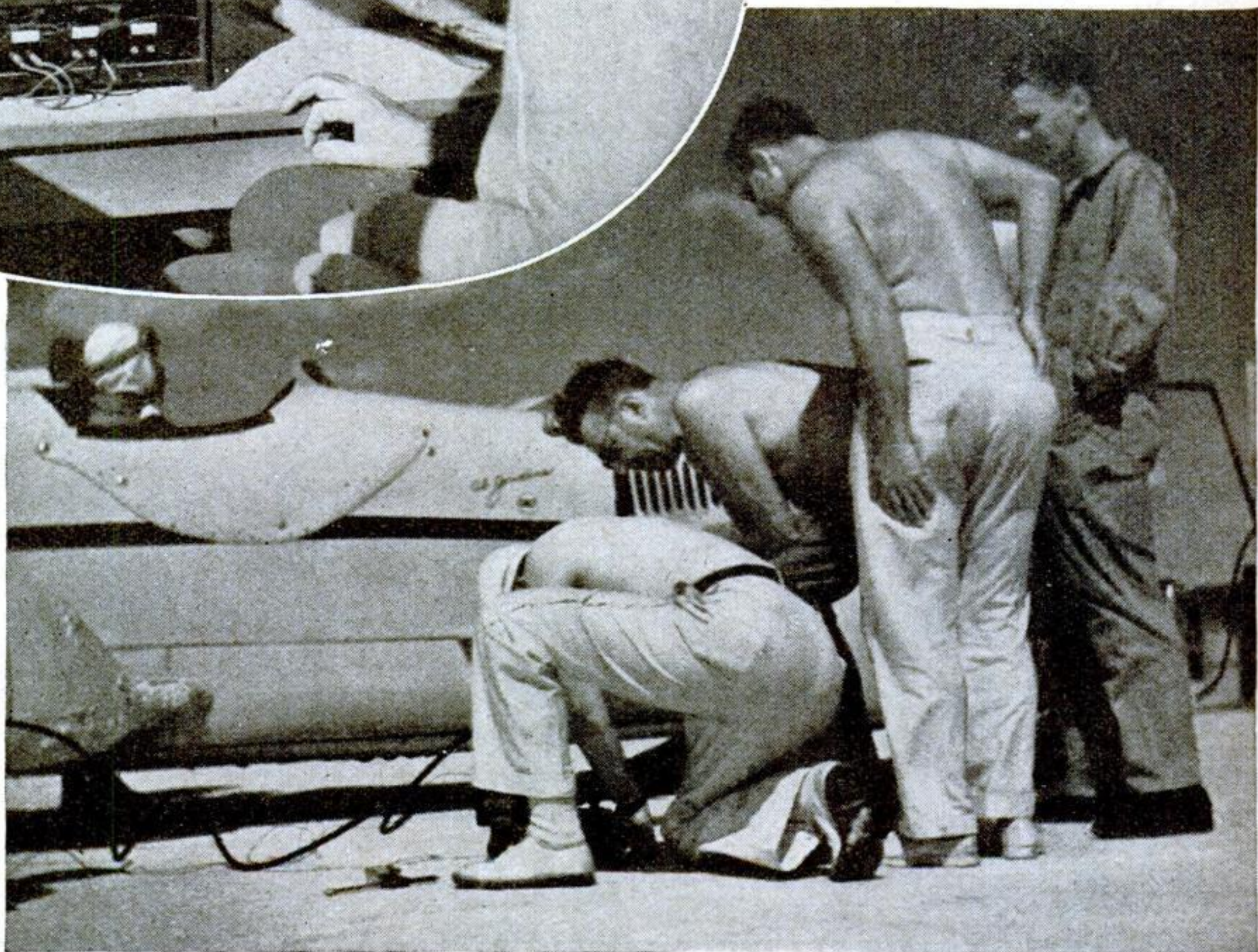
Down the center of this isolated stretch, workmen have painted a straight black line, eight inches wide. Drivers, aiming their streaking machines along this line, have six miles in which to gain maximum speed. Then, they flash across the measured mile.

Since 1927, the world's record has risen from under 200 to over 300 miles an hour. At this rate, it is possible that this generation may see the automotive engineers' dream come true—land machines that can cover a mile with the speed of sound!



At top, a driver's manager and an official watch as a car races against time. Above, the intricate timing apparatus that records speed

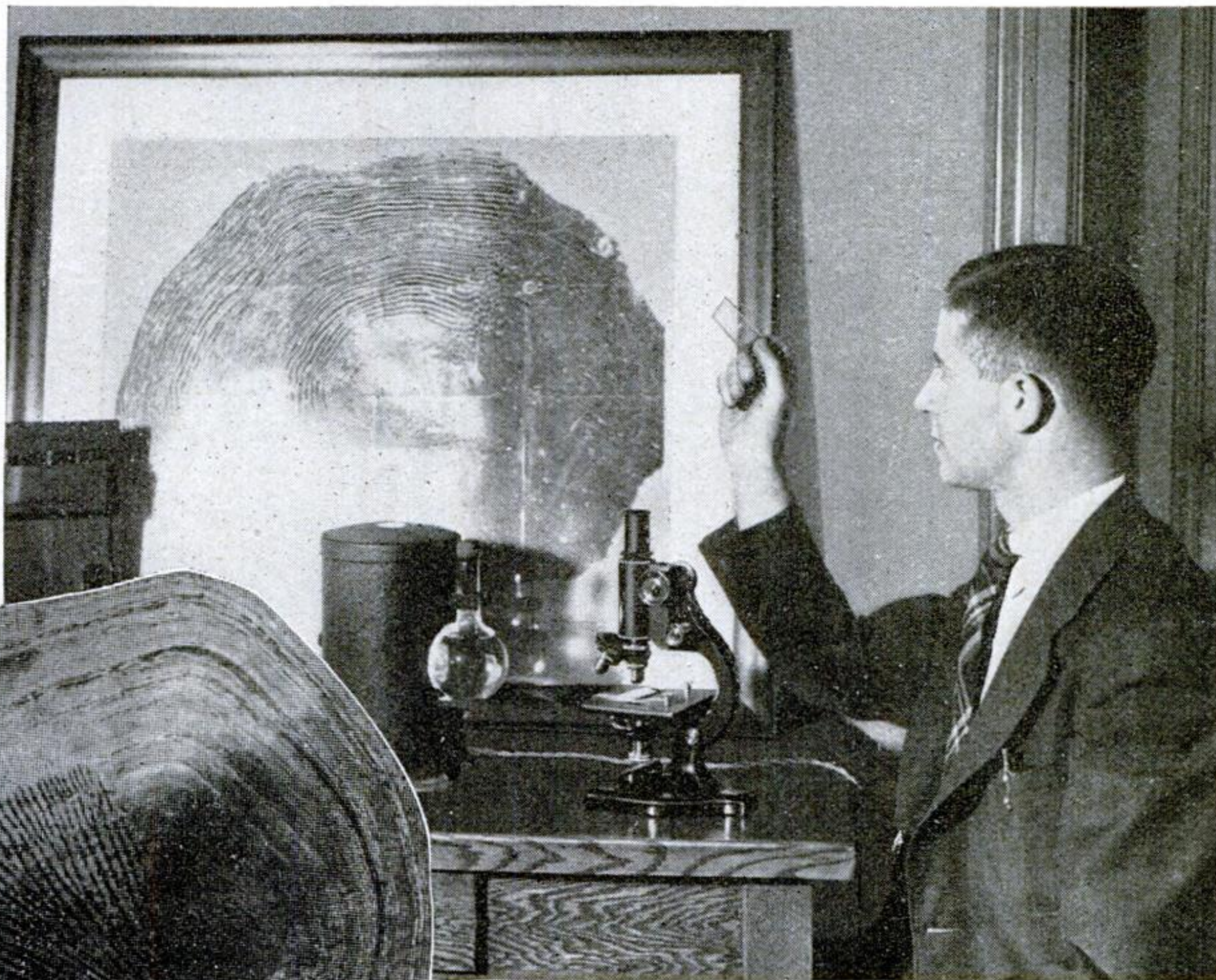
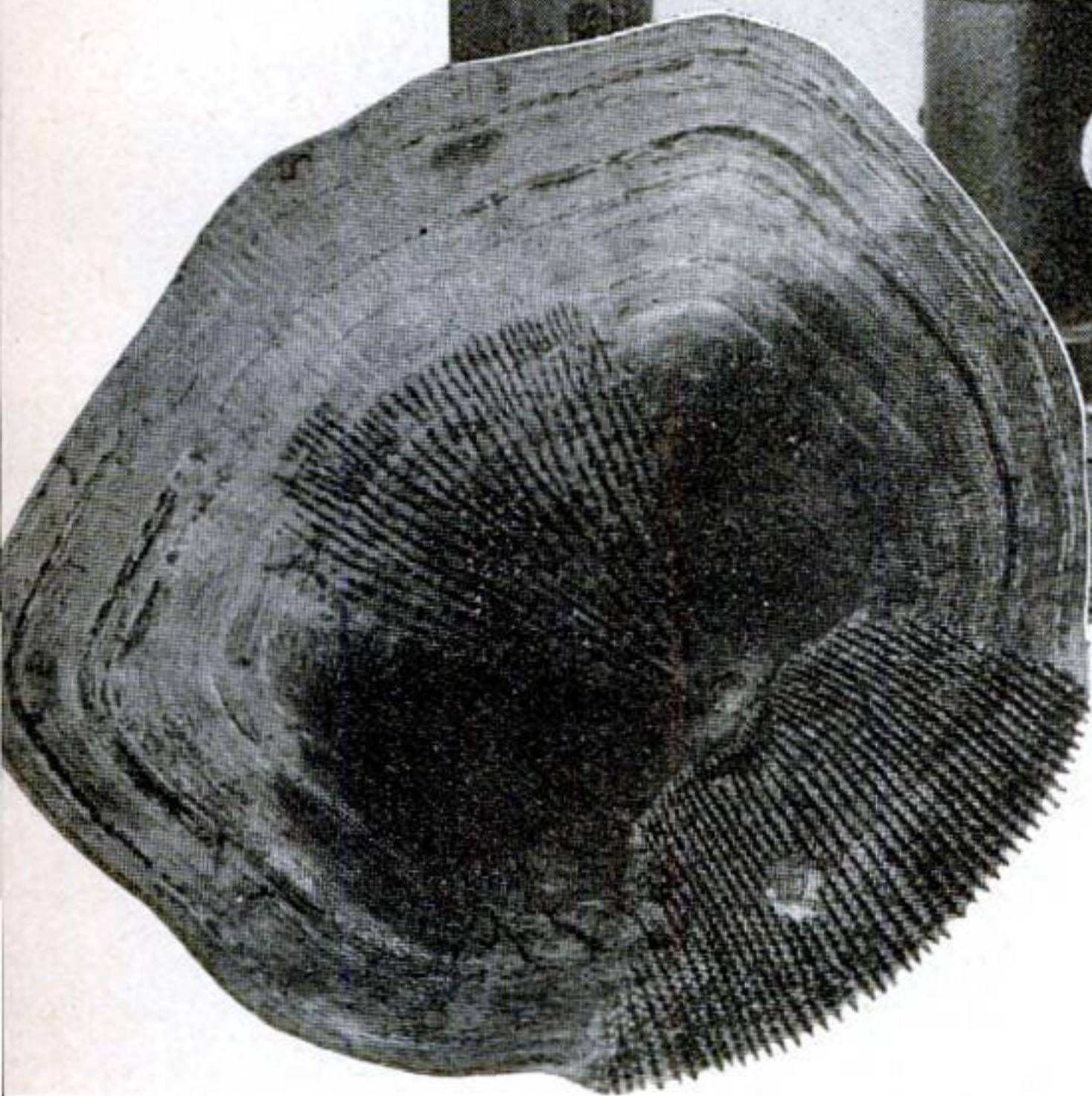
Mechanics, stripped to the waist, bend over a sensitive instrument that shows whether a racer's tires have been heated to the bursting point in the run



Scales Tell Fish's Life History

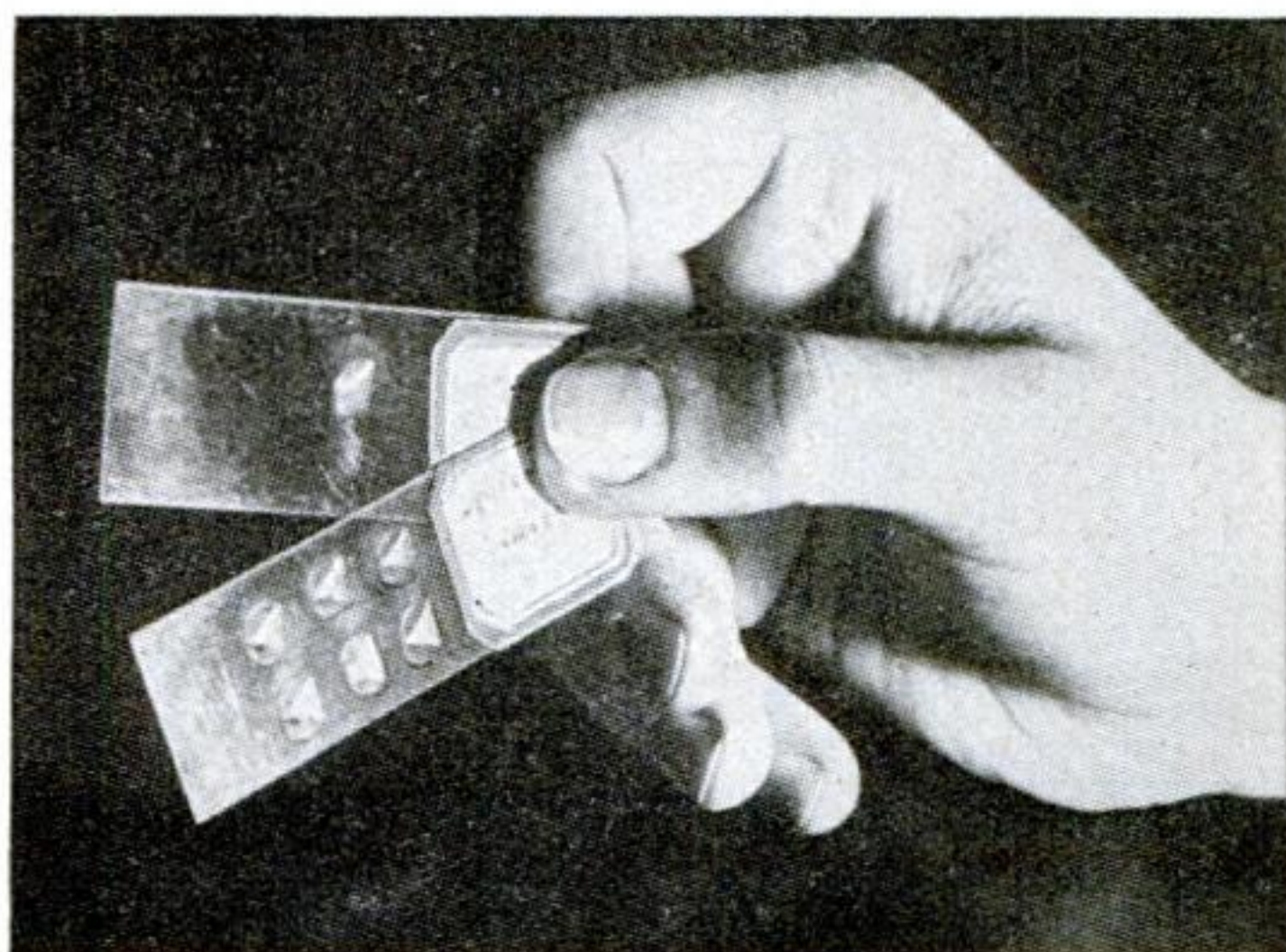
A Bureau of Fisheries expert delves into a fish's past by examining a photograph of a scale

Below, a scale as seen through a microscope, showing rings that reveal fish's growth

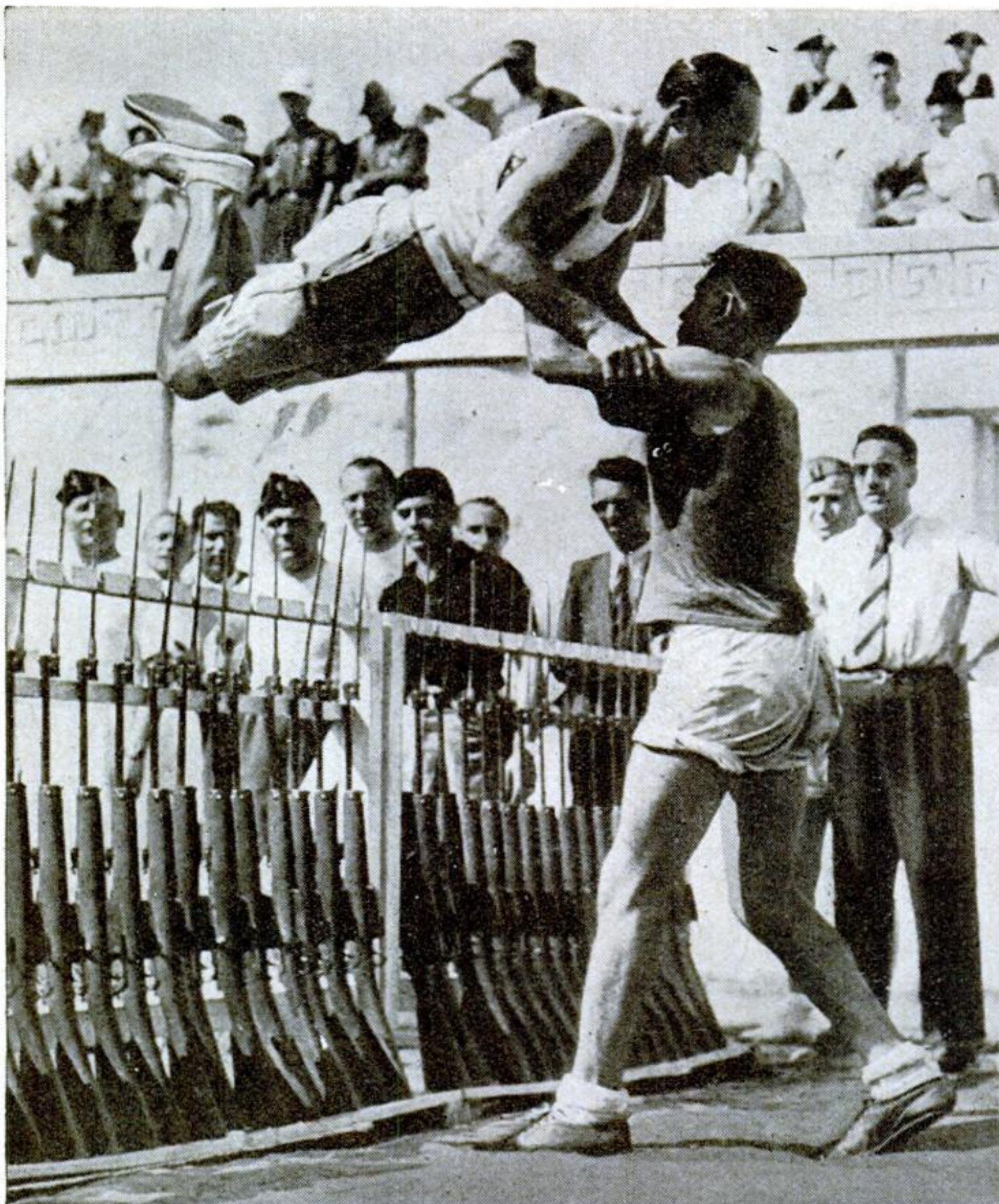


RINGS appearing on the scales of fish are now being made to reveal important facts concerning the life histories of individual fish specimens, much as the rings found in a tree trunk tell the story of the tree's growth and age. In a method worked out by scientists of the United States Bureau of Fisheries, Washington, D.C., fish scales are examined under powerful microscopes, and their images are projected in enlarged form on a screen by transferring the fish-scale pattern to celluloid slides. This is done by softening a celluloid strip, either by moistening its surface with an alcohol solution, or by inverting it over the mouth of a bottle containing acetone so that the rising vapors come in contact with the slide. A scale that has been thoroughly dried is then placed on the softened celluloid surface and inserted between the dies of a press of the type used in applying official seals to legal papers. By studying the scale as projected from the slide

onto a screen, scientists can determine the age of the fish, its approximate length at any specific year of its life, and also exactly how much its length increased during any one-year period. The age is established by counting the number of rings on the scale, while its length in any given year is computed with the aid of measurements on a scale taken from a fish of the same species whose length is definitely known. Such information is of value to the Bureau of Fisheries in studying the habits of fish and preparing data for the benefit of commercial fishermen.



Fish-scale slides for projection. They are made by pressing the scales into softened celluloid strips



A Fascist party leader clearing a hedge of bayonets in a test at Rome

Bayonet Dive Is Physical Exam

DIVING over a hurdle formed by rifles stood in a row with fixed bayonets was one of the stunts tried by Italian government officials to demonstrate their physical fitness to Premier Mussolini at a recent gymnastic exhibition held in Rome. Several Fascist party chiefs were injured when they failed to clear the bayonet barrier, while others were slightly burned while attempting to leap through blazing hoops.

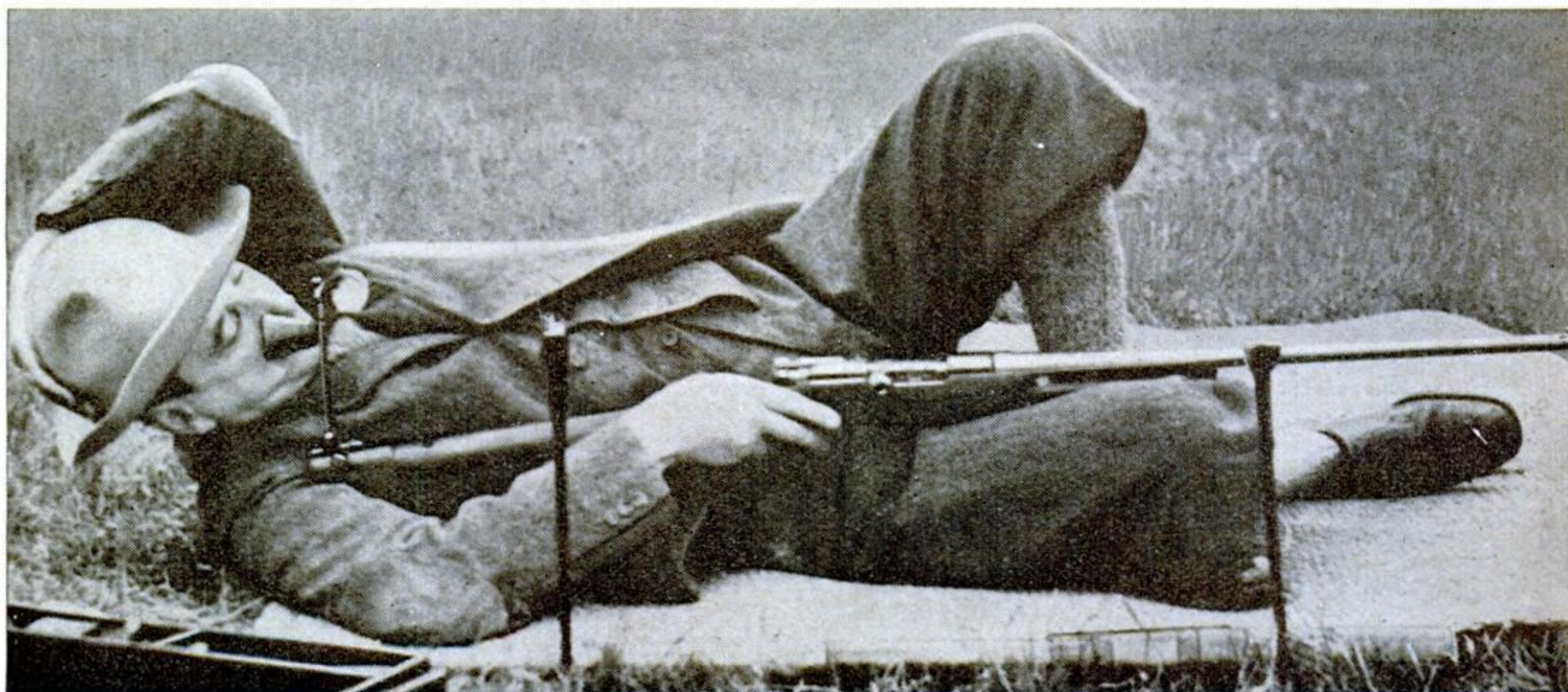
Trailers May Get Roof Gardens

TRAILER tourists of the future will be able to gather vegetables from gardens on the tops of their rolling homes, according to a prediction made recently by Carleton B. Ellis, famous inventor, who has been conducting researches in the growth of plants in chemical solutions.

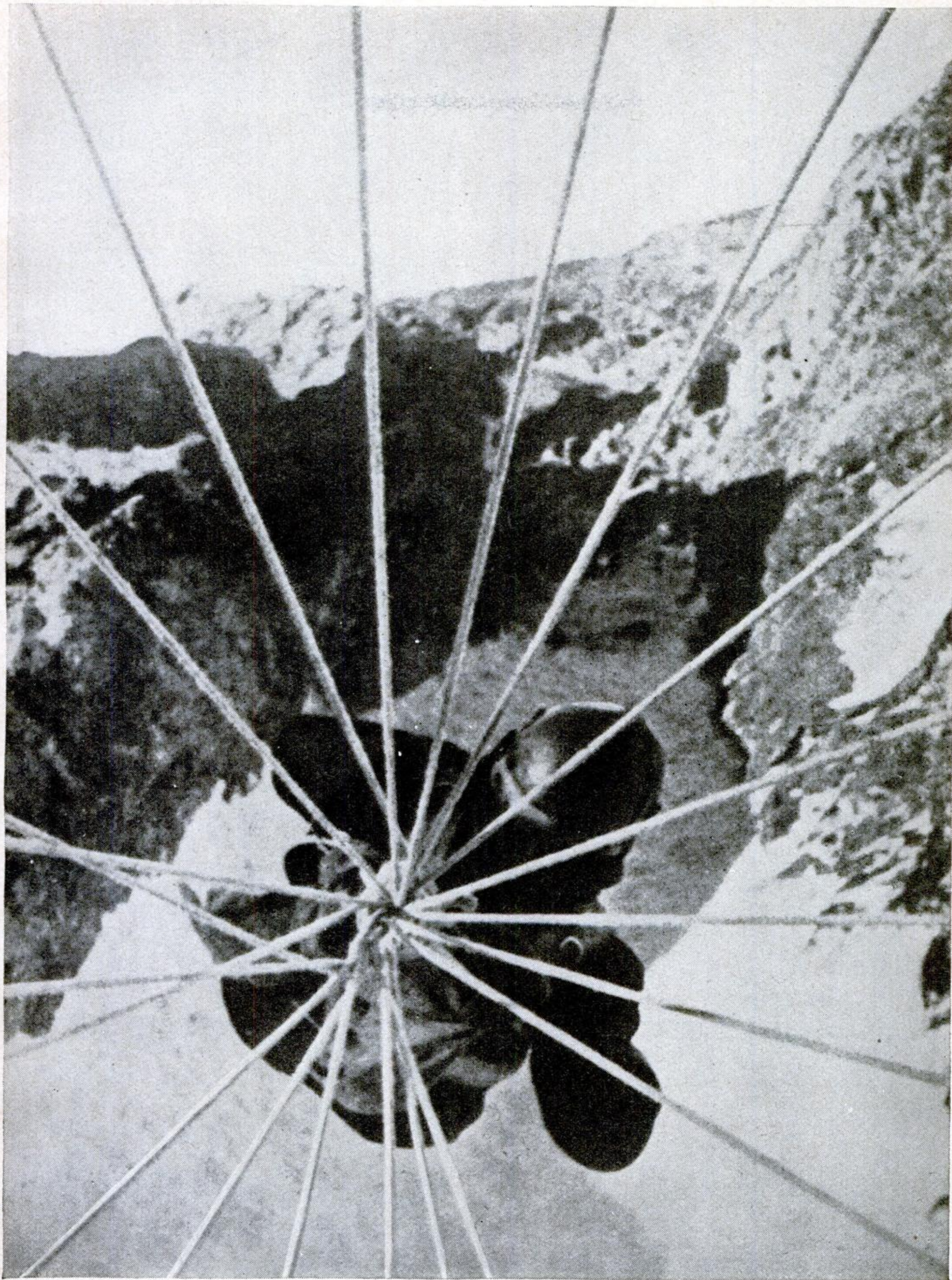
British Marksman Uses Novel Firing Position

TO OBTAIN greater accuracy in shooting, one contestant in a recent target match held at Bisley, England, mounted his rear sight on an upright fitted to the end of his rifle butt.

This necessitated the odd firing position shown below, in which the marksman lies on his back, supporting his gun with his knee and his head with his arm.



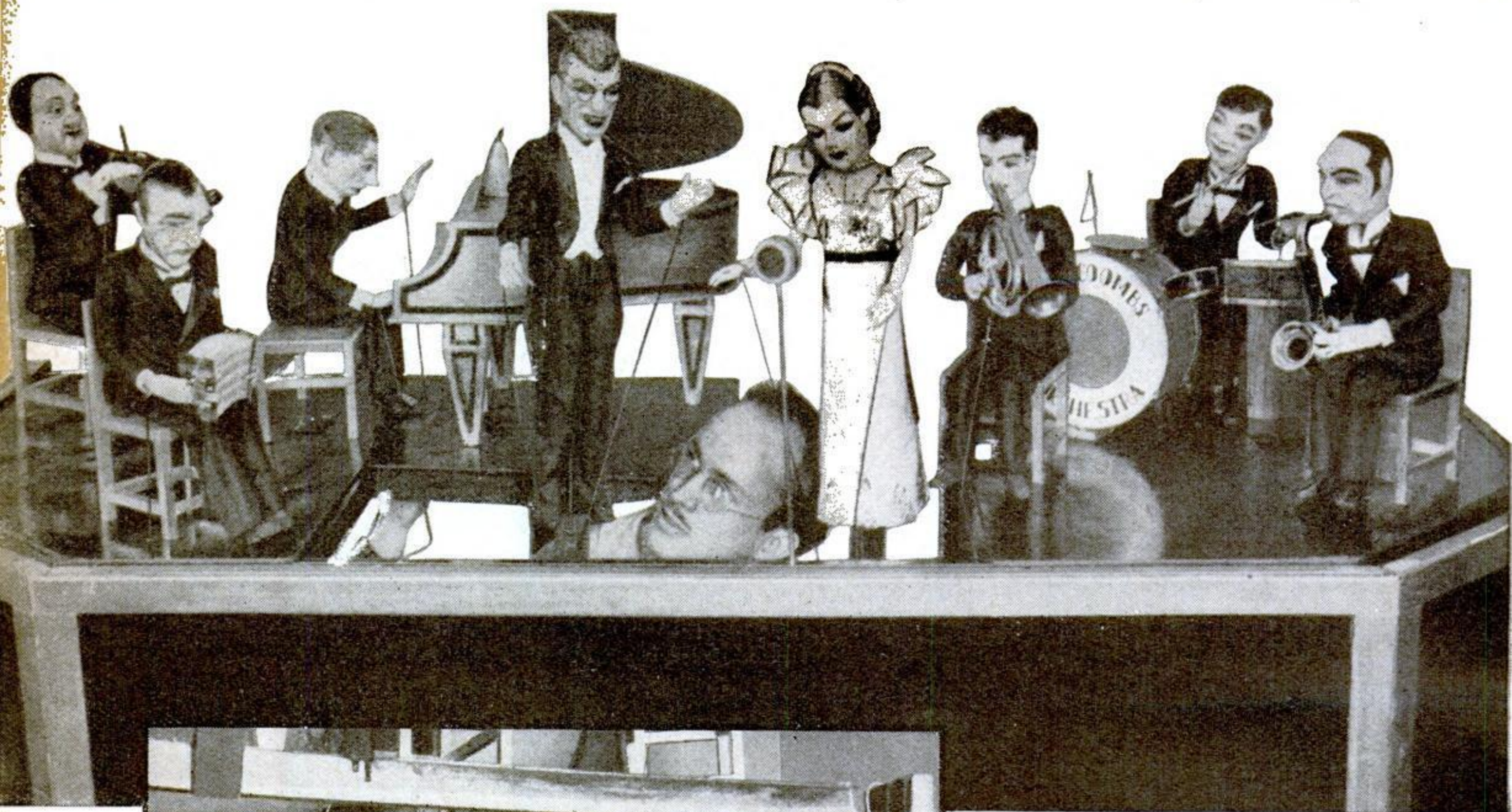
If rifle shooting is too strenuous for you, try this Britisher's method of using a rear peep sight



Can You Guess What This Is?

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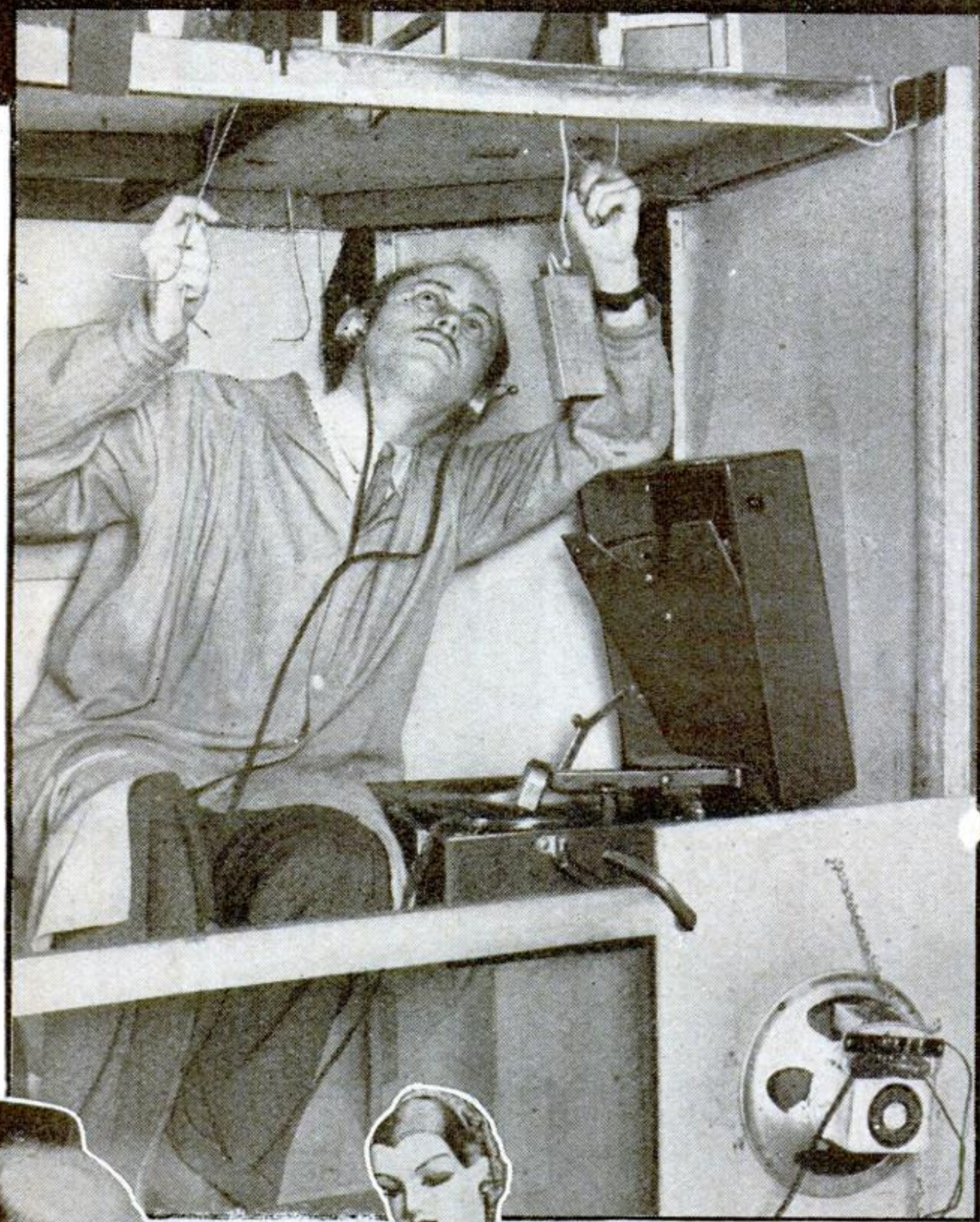
AT FIRST glance, this remarkable picture suggests a black spider lurking in its web. But, in reality, it is Ernst Udet, famous German stunt flyer, photographed from above by an automatic camera attached to the top of his parachute, as he descended after a leap from his plane.



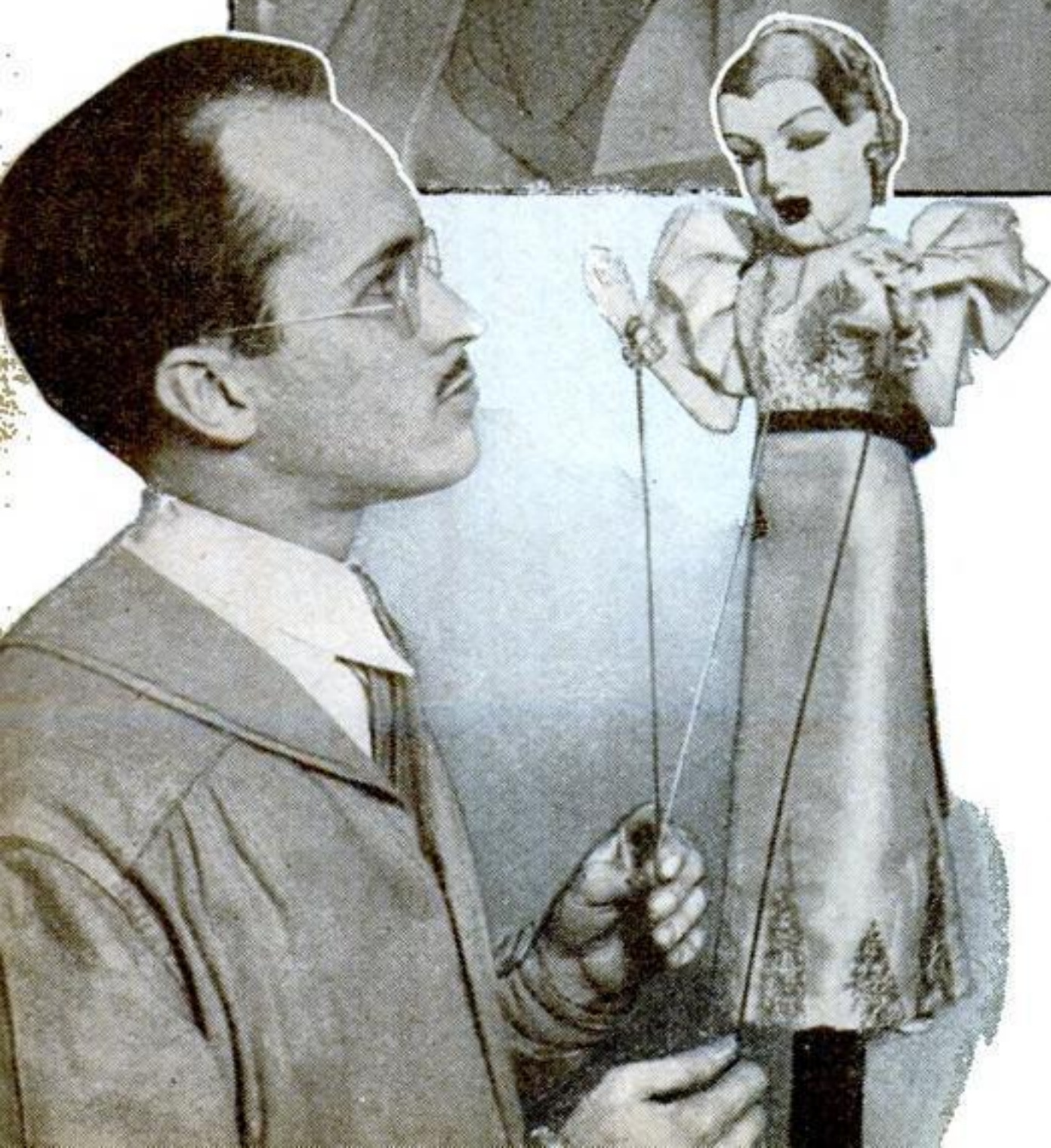
Jack Coombs manipulates the tail-coated leader who conducts the puppet orchestra

Puppet Orchestra Accompanies Tiny Blues Singer

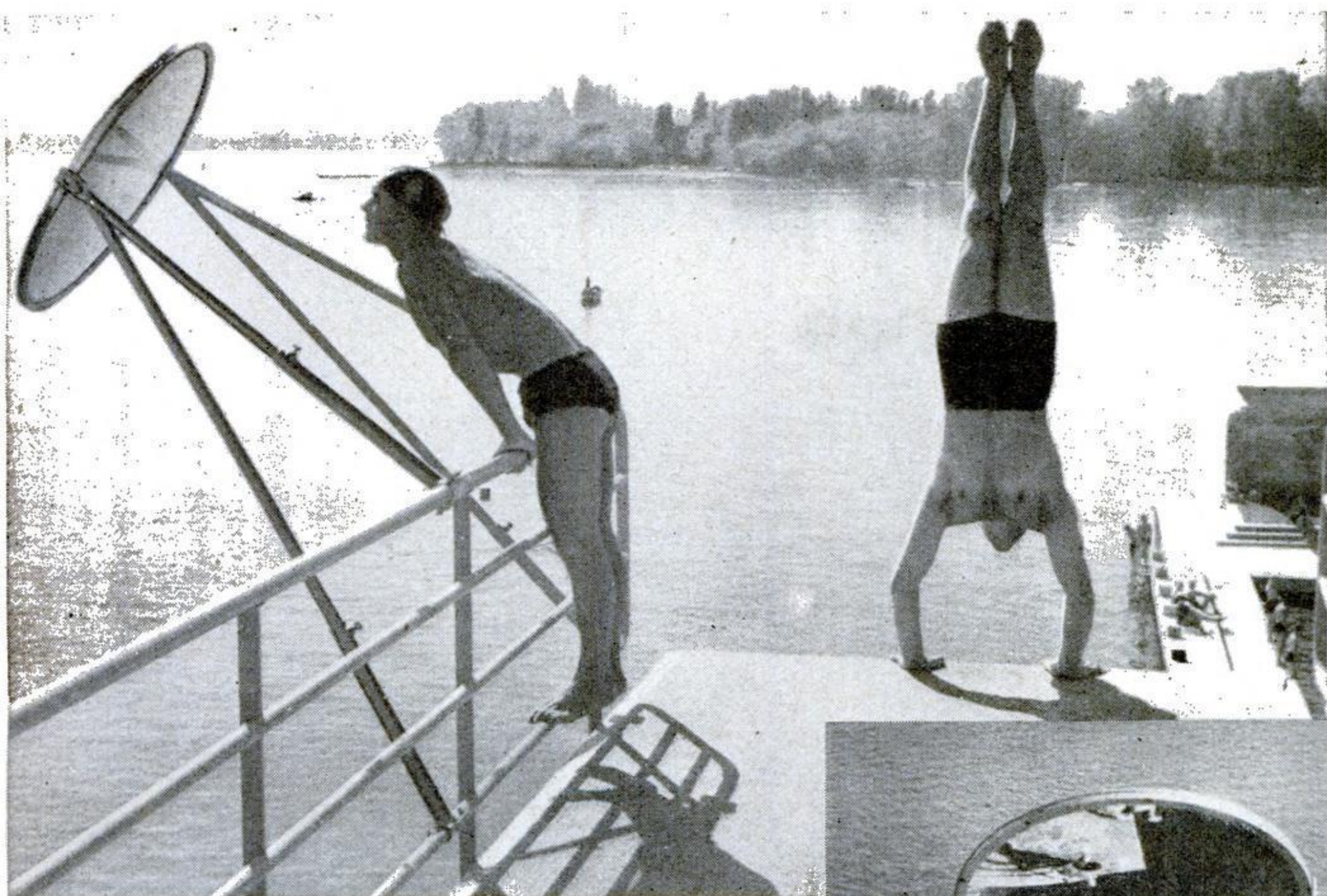
EIGHT mechanical musicians perform realistically in a puppet orchestra constructed by Jack Coombs, New York City designer and lighting engineer. Instead of controlling movements of the doll performers with black-silk strings from a concealed bridge above the stage, Coombs uses thin metal rods and places the marionette operators below the stage, with the puppet control rods running up through small holes in the stage floor. Square peep holes are provided so that the operators can observe the puppets in action. Specially prepared high-fidelity phonograph records provide all the orchestra music, singing, sound effects, and dialogue through a loudspeaker system, thus removing this burden from the puppet operators. For added dialogue or special sound effects, however, operators can cut in on the recorded programs by means of a crystal-type microphone mounted in the compartment under the stage. The use of rods instead of overhead strings, it is claimed, allows elaborate lighting and scenic effects to be used, and results in a more natural and less jerky movement of the marionettes.



Phonograph records provide the singing, orchestra music, and dialogue, while a microphone can be used for incidental effects

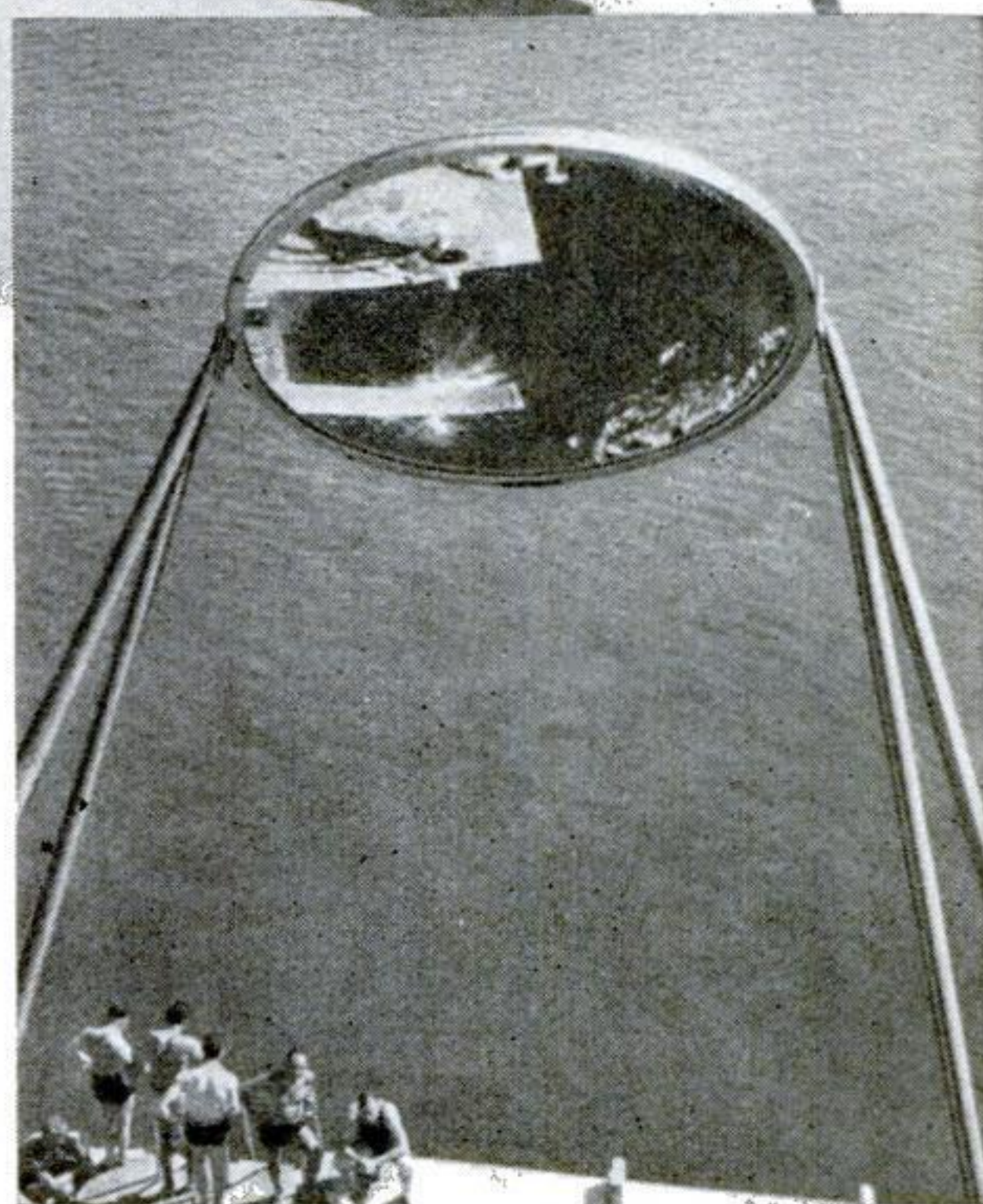


A string operates the tiny singer's mouth; metal rods are used to move her hands

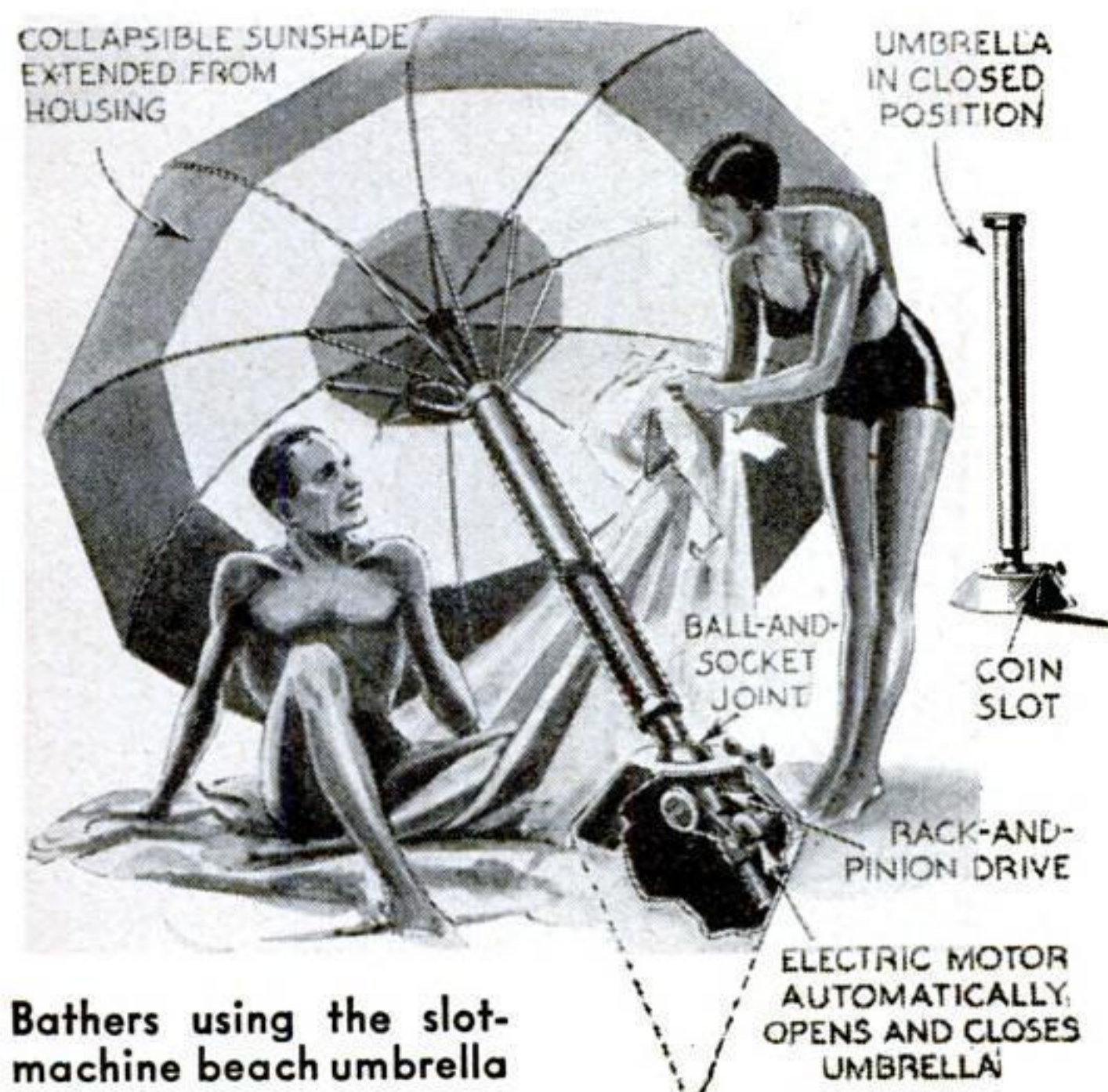


Mirror Shows Divers If "Coast Is Clear"

WHEN diving from a high platform projecting out over the water, it is often difficult to see whether anyone is swimming on the surface near the spot where a diver will enter the water. To remove this hazard, officials at a Swiss bathing resort set up the large mirror pictured above and at the right. Divers can now glance in the mirror before leaping from the platform to make sure they will not land on anyone in the water.



Projecting to one side, the mirror gives a clear view of water at the base of tower



Bathers using the slot-machine beach umbrella

Coin-in-a-Slot Umbrella Designed for Beaches

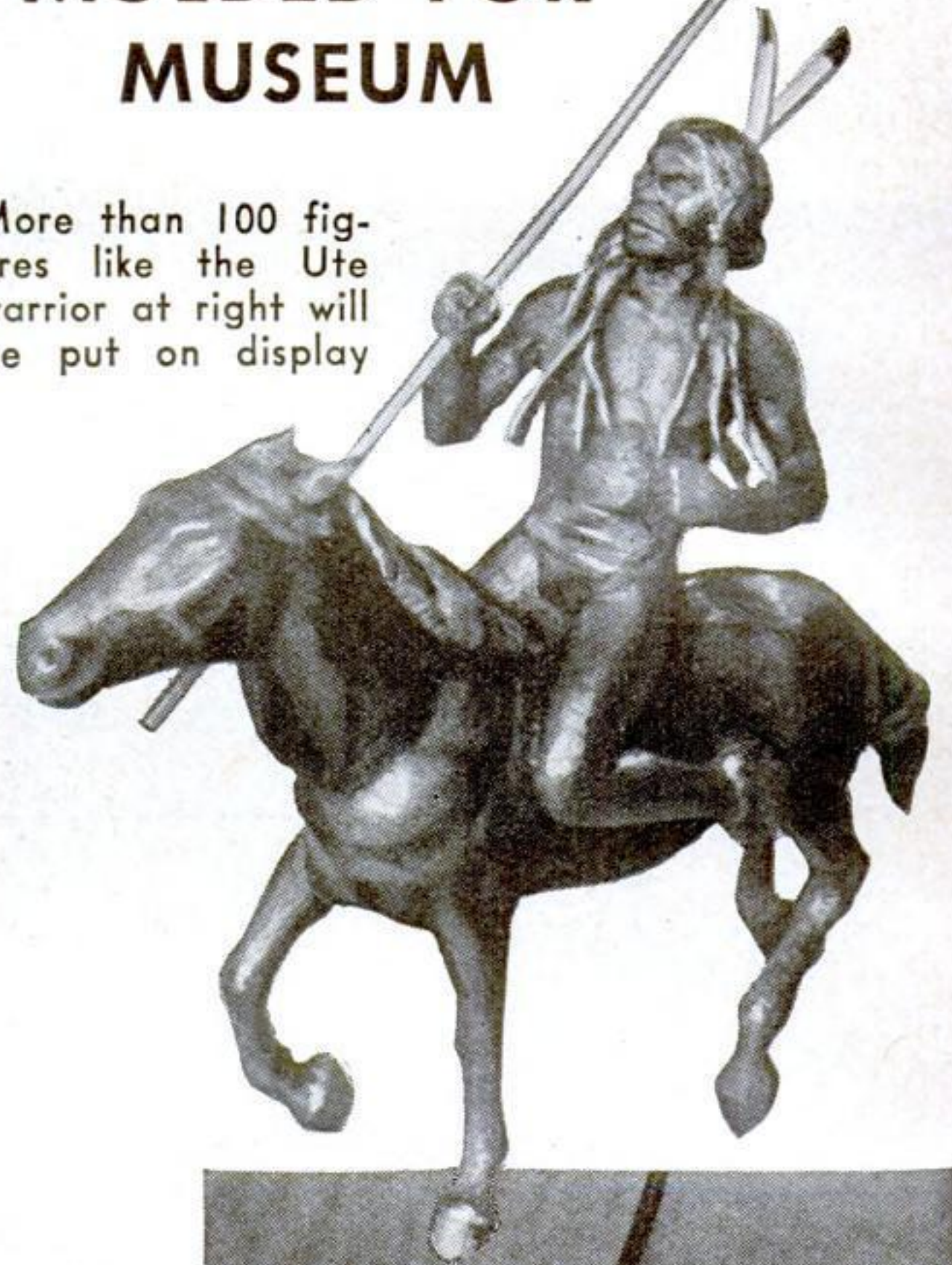
OPENING automatically when a coin is inserted in a slot, a mechanical beach umbrella devised by a California inventor folds up at the end of the period paid for. Electricity, supplied through a cable buried in the sand, supplies current for the mechanism housed in the base, which forces the umbrella out of a tubular housing and then draws it back in again after a predetermined time. The tubular umbrella standard is mounted on a ball-and-socket joint so that it may be turned or tipped at any angle to shade the user from the sun.



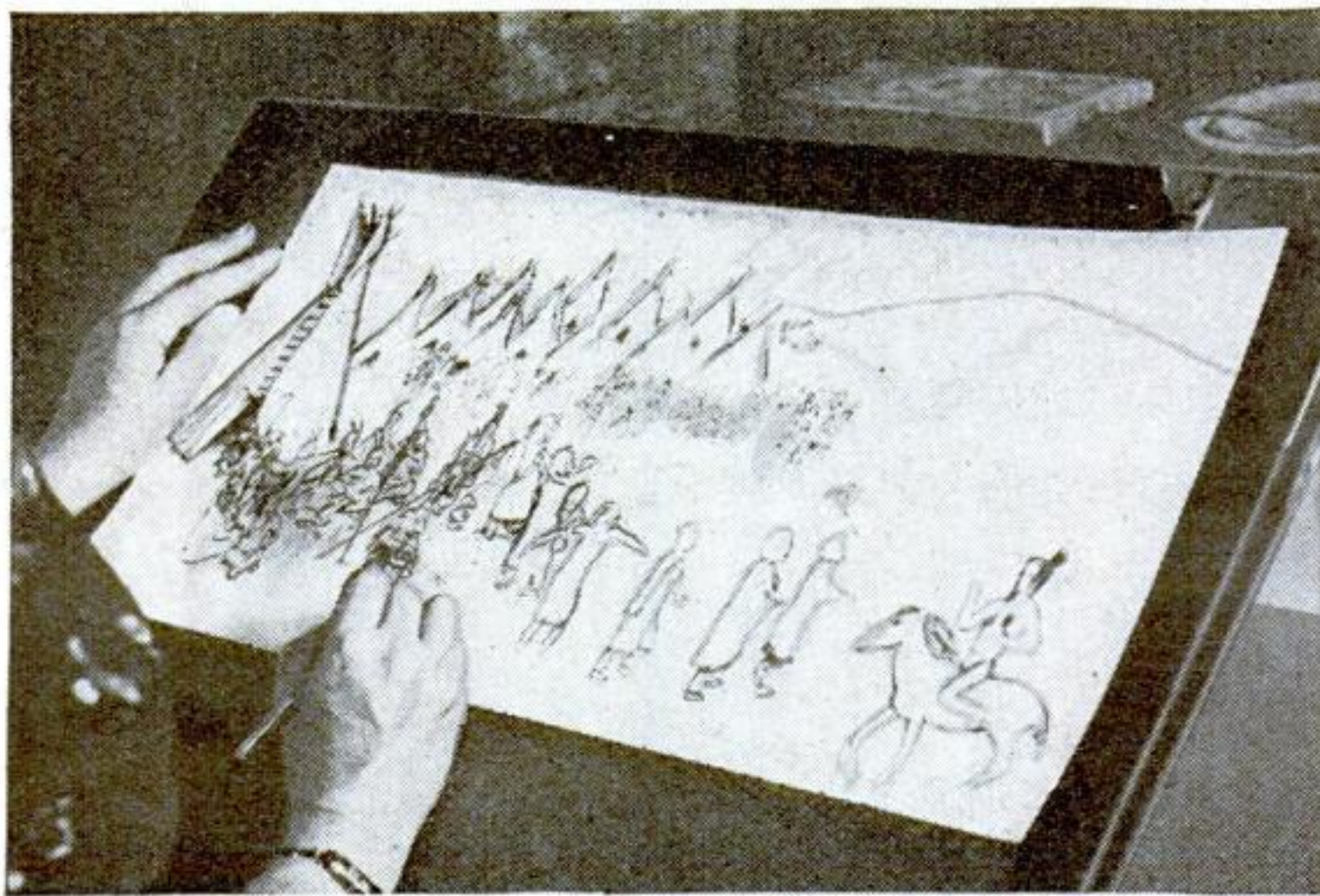
Tiny Wax Redskins

MOLDED FOR MUSEUM

More than 100 figures like the Ute warrior at right will be put on display

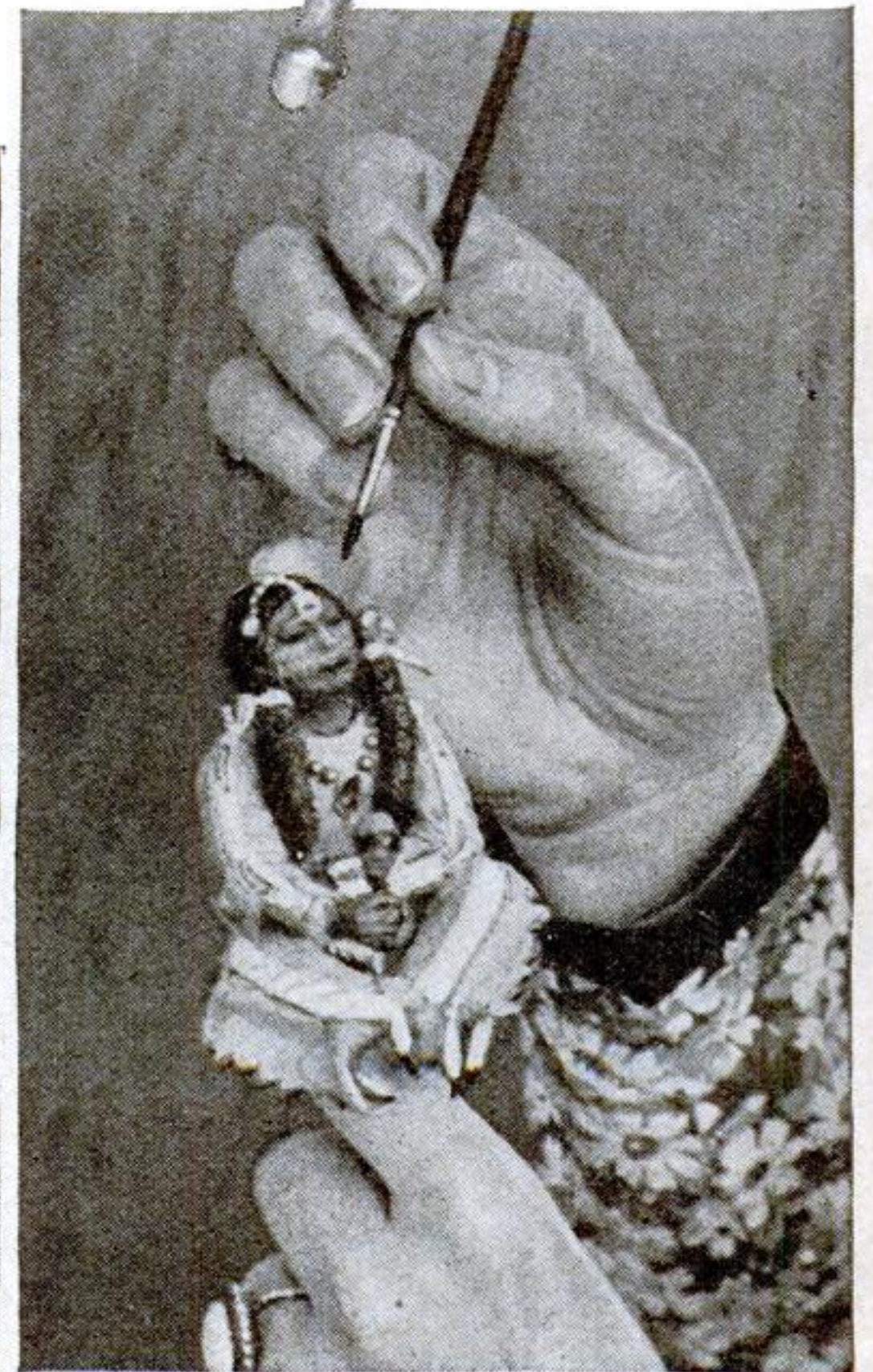
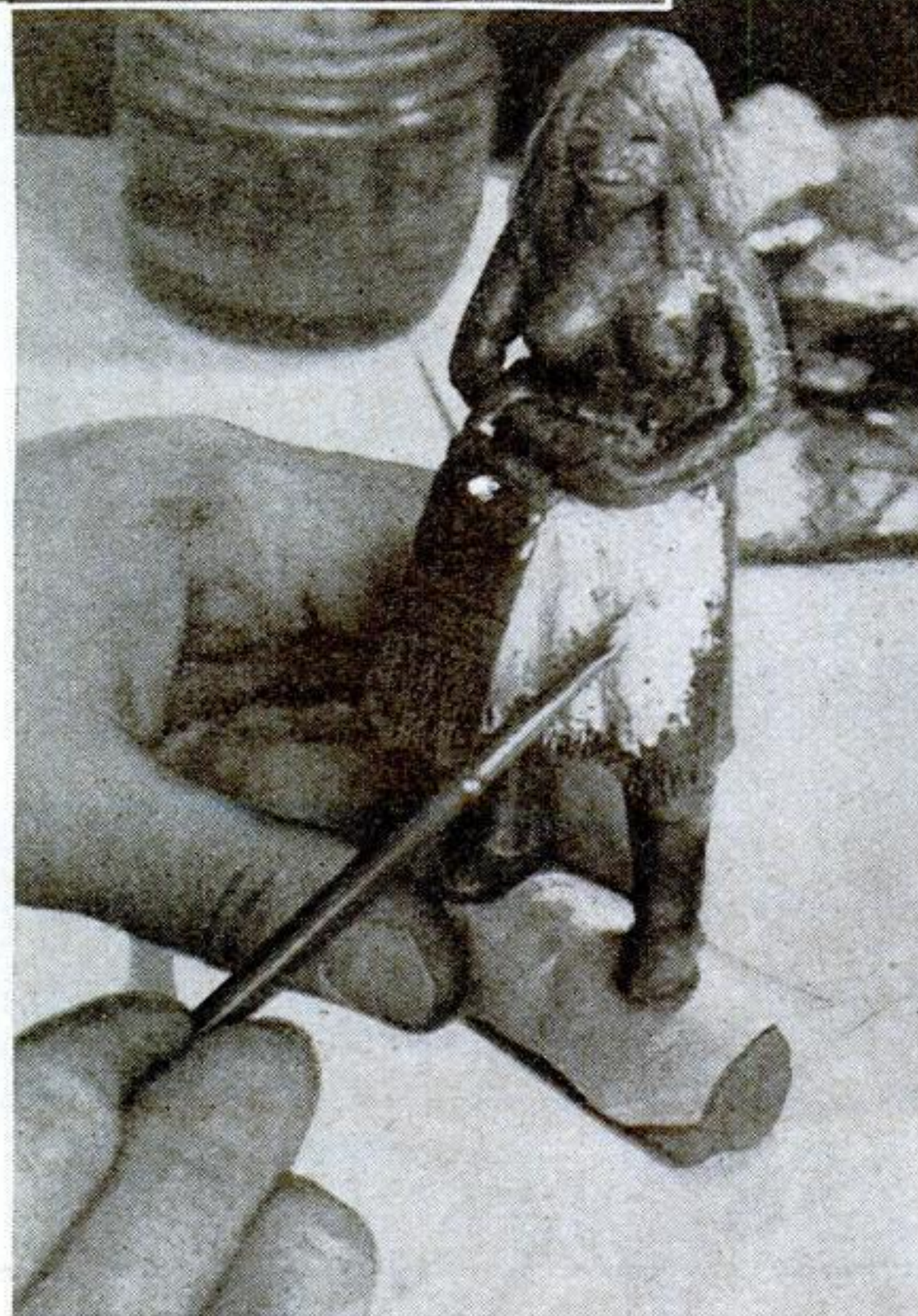


First modeled in clay, the figures are cast in a preparation of beeswax and resin and then bent into the desired shape. Details are added with heated steel tools



A preliminary sketch of the complete model Indian village serves as a guide for making and placing the carefully modeled pieces

After the figures are painted, parts representing clothing are given the appearance of soft, white buckskin by applying talcum powder, which is then wiped off. Here this treatment is being given to a skirt on an image of a squaw

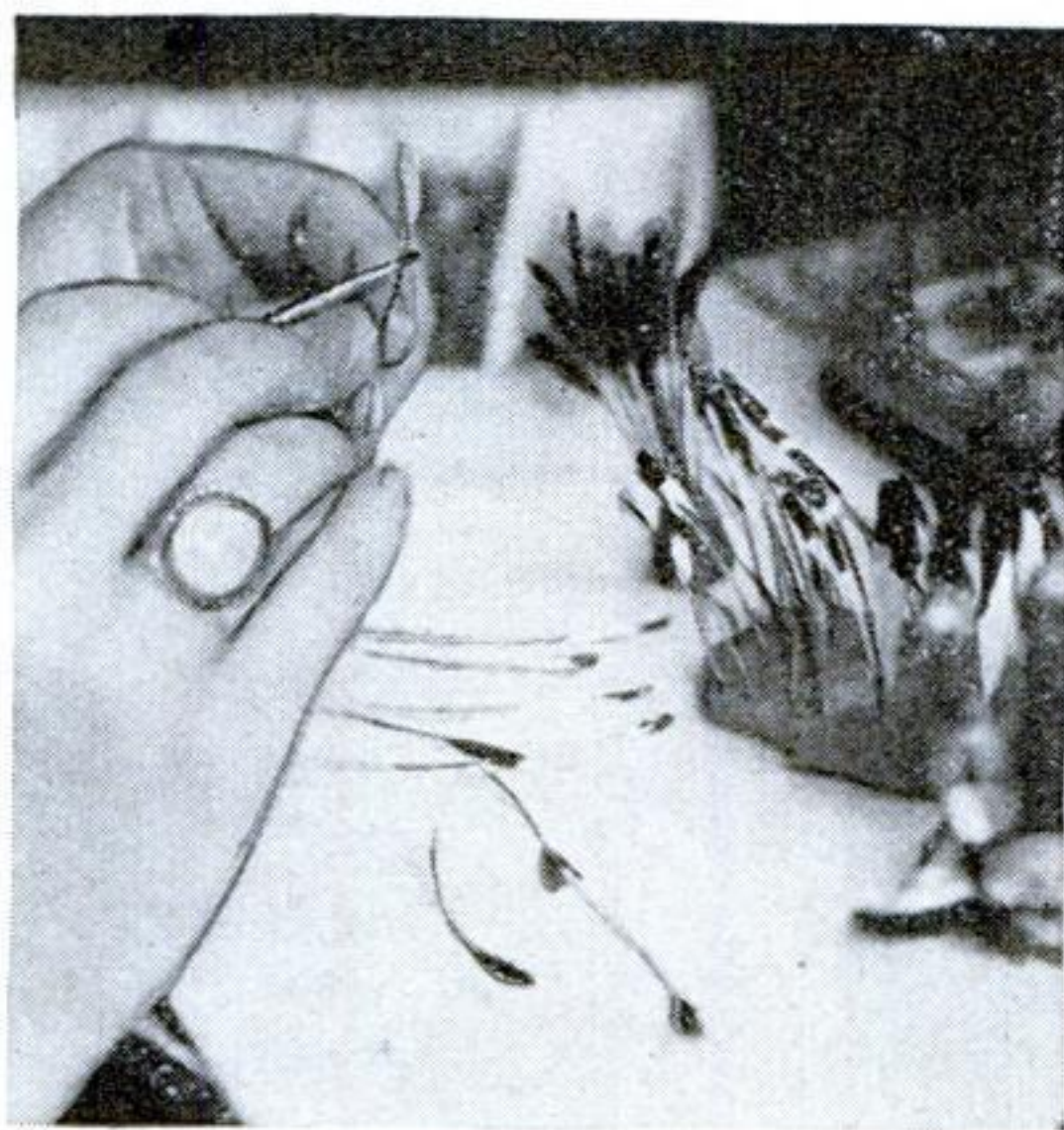


Putting on the finery. Gilded birdshot gives a realistic imitation of the hawks' bells worn by the women



Three model makers at work at the Colorado State Museum in Denver, fashioning figures for the miniature exhibit. Three different stages of the work are seen

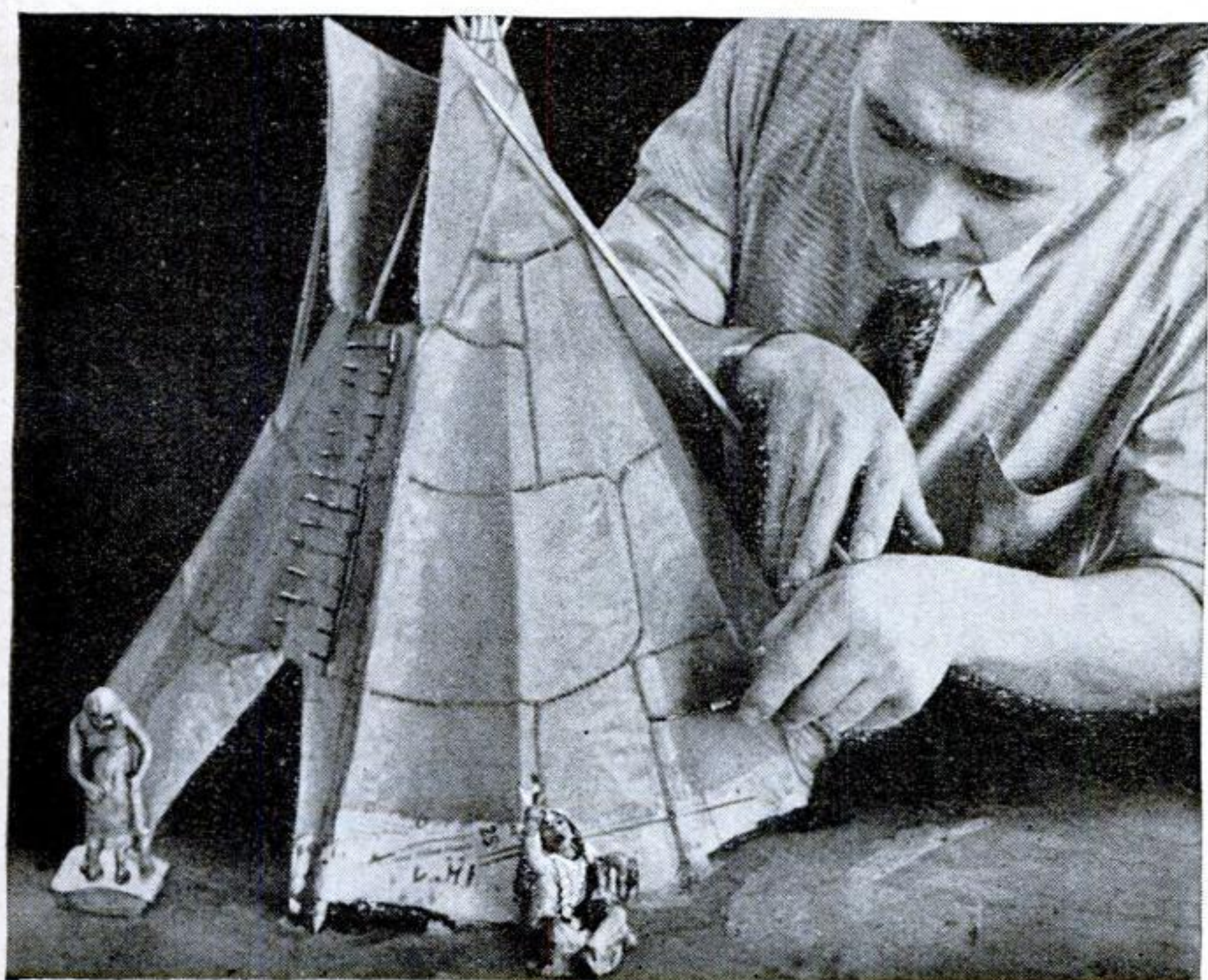
FOR more than a year, artists at the Colorado State Museum have been creating tiny but accurate wax models of Indians. More than 100 of the figures will be combined to portray the Scout Dance of the Utes, in one of a series of exhibits of Indian life. Photographs on these pages show how the craftsmen produce a model, using such strange accessories as pinheads, sparrow feathers, bird shot, and buffalo hairs.



English sparrows furnish "eagle feathers" for the warriors. The tiny plumes are painted by hand



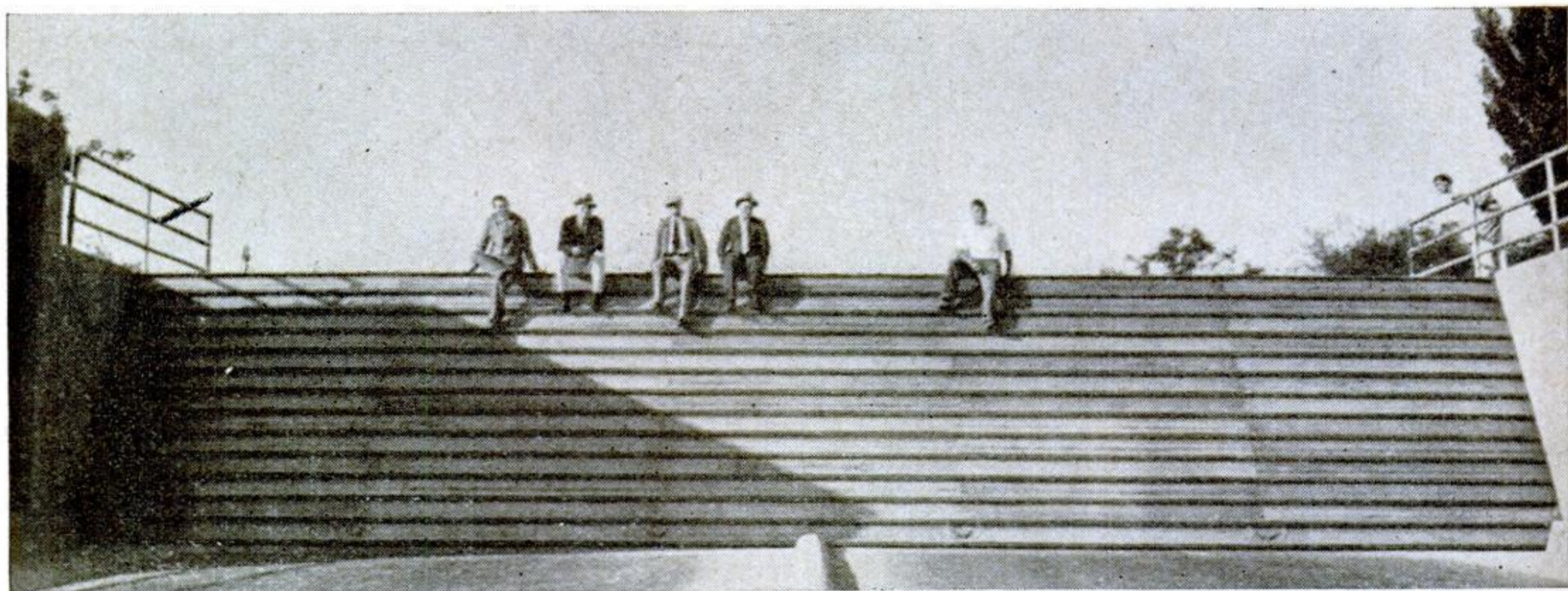
A brave with a rattle. Painted pinheads represent bone hair ornaments



Buffalo hair, plucked from an old robe, being braided for the heads of the figures. It closely resembles Indian hair

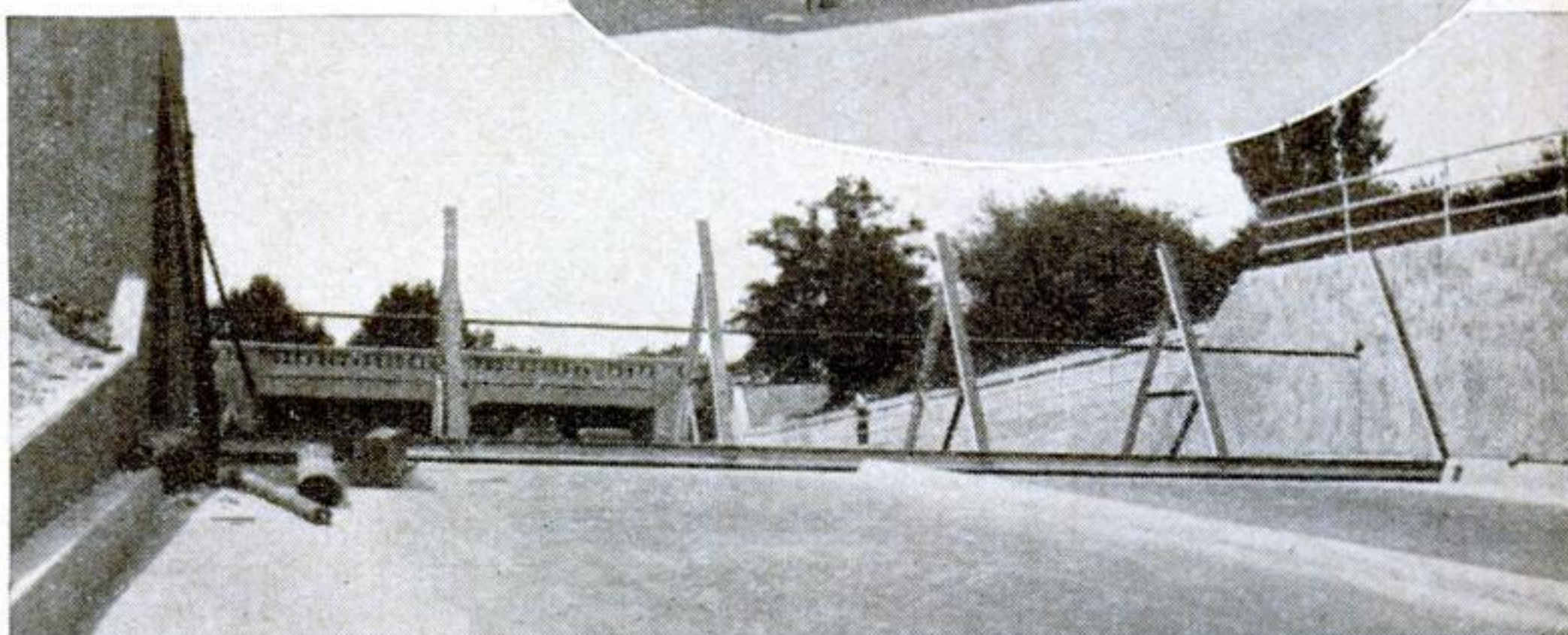
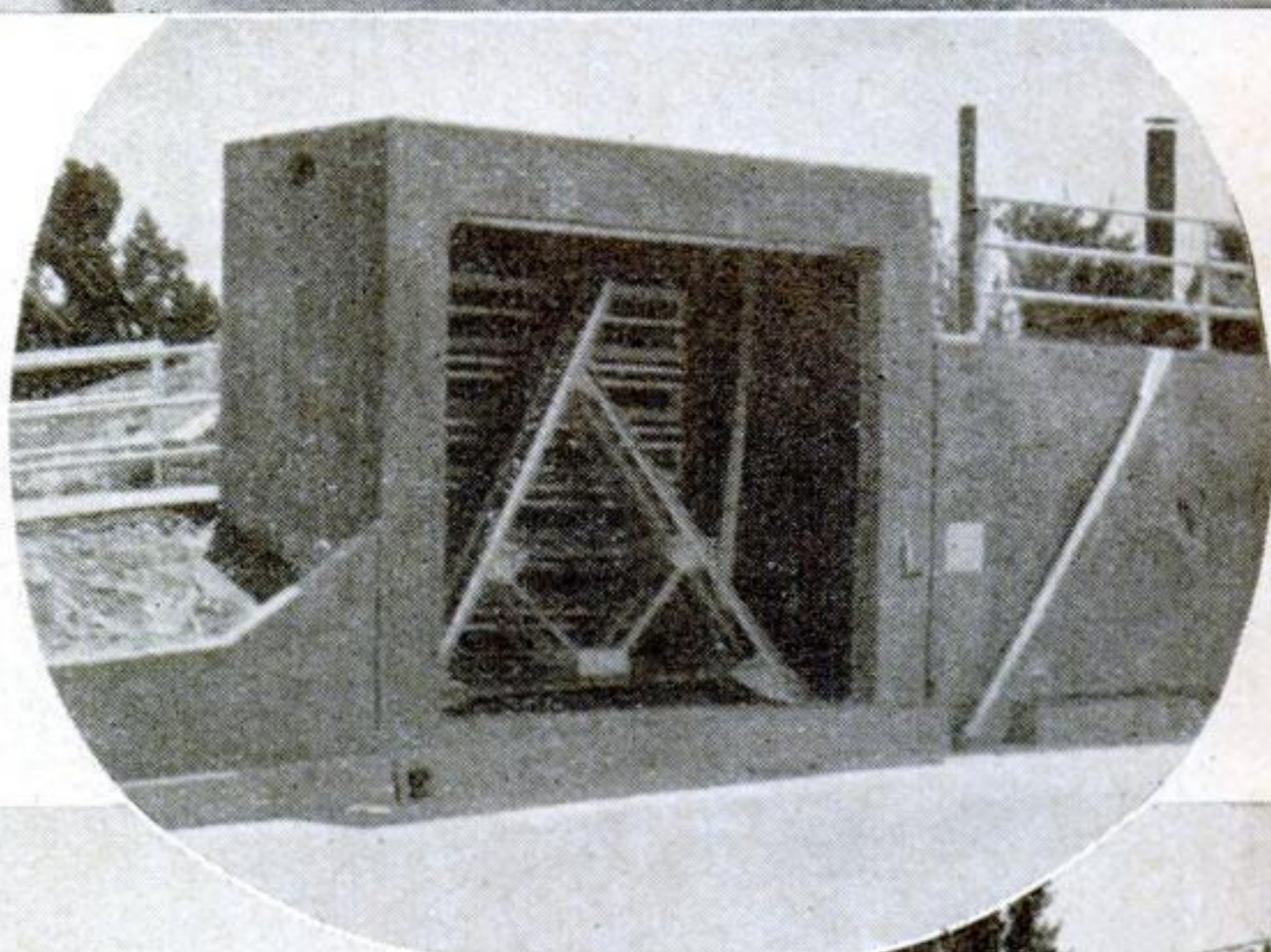
At left, a worker is putting the finishing touches on a model of a medicine lodge. Tiny cuts in the papier-mâché cover simulate stitches

Portable Emergency Dam Can Be Set Up by One Man



This dam can be put up quickly in an emergency to keep flood waters out of a highway underpass

FOLDING compactly into a storage chamber when not in use, a portable dam in Sacramento, Calif., protects a highway underpass from flood waters in case of an emergency. Made of aluminum-alloy units, the dam is set up in front of the underpass by mounting individual aluminum sections on A-shaped frames spaced across the roadway with their rear legs braced in recesses built into the pavement. Special rubber strips seal the joints between the dam sections to prevent leaking. Although each aluminum unit is light enough that it can be set into place by one man, the completed dam is sufficiently strong to withstand a load of 650 pounds to the square foot against it at the bottom, according to its designers.



The supporting framework in place. Oval shows the complete dam taken apart and stowed away in the concrete storage chamber built into the wall



Illuminating bulbs are powered by the car's battery

Lighted Make-up Mirror Fits Glove Compartment

MOUNTED inside the glove compartment on the dashboard panel of an automobile, an illuminated mirror is a handy accessory for women motorists. Hinged brackets allow the glass to be swung back into the compartment when it is not in use, and hold it in a convenient position when it is needed. Two light bulbs set into the frame are powered by the car battery, and give enough light for applying make-up or for reading road maps at night. The device can be installed in any car having a glove compartment.



Soldiers of the 18th U. S. Infantry trying out the new service arm, which fires four times as fast as the Springfield rifle

U. S. Army Gets New Fast-Firing Infantry Rifle

REPLACING the Springfield-type rifle, a new firearm which is semiautomatic in operation is soon to be introduced as standard equipment for infantrymen in the United States Army. The new rifle, which is shown being

tried out by soldiers of the 18th Infantry in the photograph above, will fire at the rate of sixty rounds a minute, four times as fast as the present Springfield rifle which has been in use for a number of years.



Sergt. C. J. Campbell of the New Jersey State Police examining a marijuana plant raised for use in identifying illegal crops

Cops Grow Marijuana for Rogues' Gallery

STATE police in New Jersey have taken over the cultivation of a small crop of marijuana, the illicit narcotic weed which is rolled into cigarettes known as "reefers." Three marijuana plants, grown from seeds imported into the state by special permission of Federal authorities, have been raised by Miss Jessie G. Fiske, state seed analyst, in a greenhouse of the State Agricultural Experiment Station at Rutgers University, New Brunswick, N.J. One plant was turned over to each of three troops of the New Jersey State Police so that officers might familiarize themselves with its appearance and thus be able to spot patches of it under illegal cultivation within the borders of the state. Miss Fiske and Sergt. C. J. Campbell are shown at left examining one of the plants.

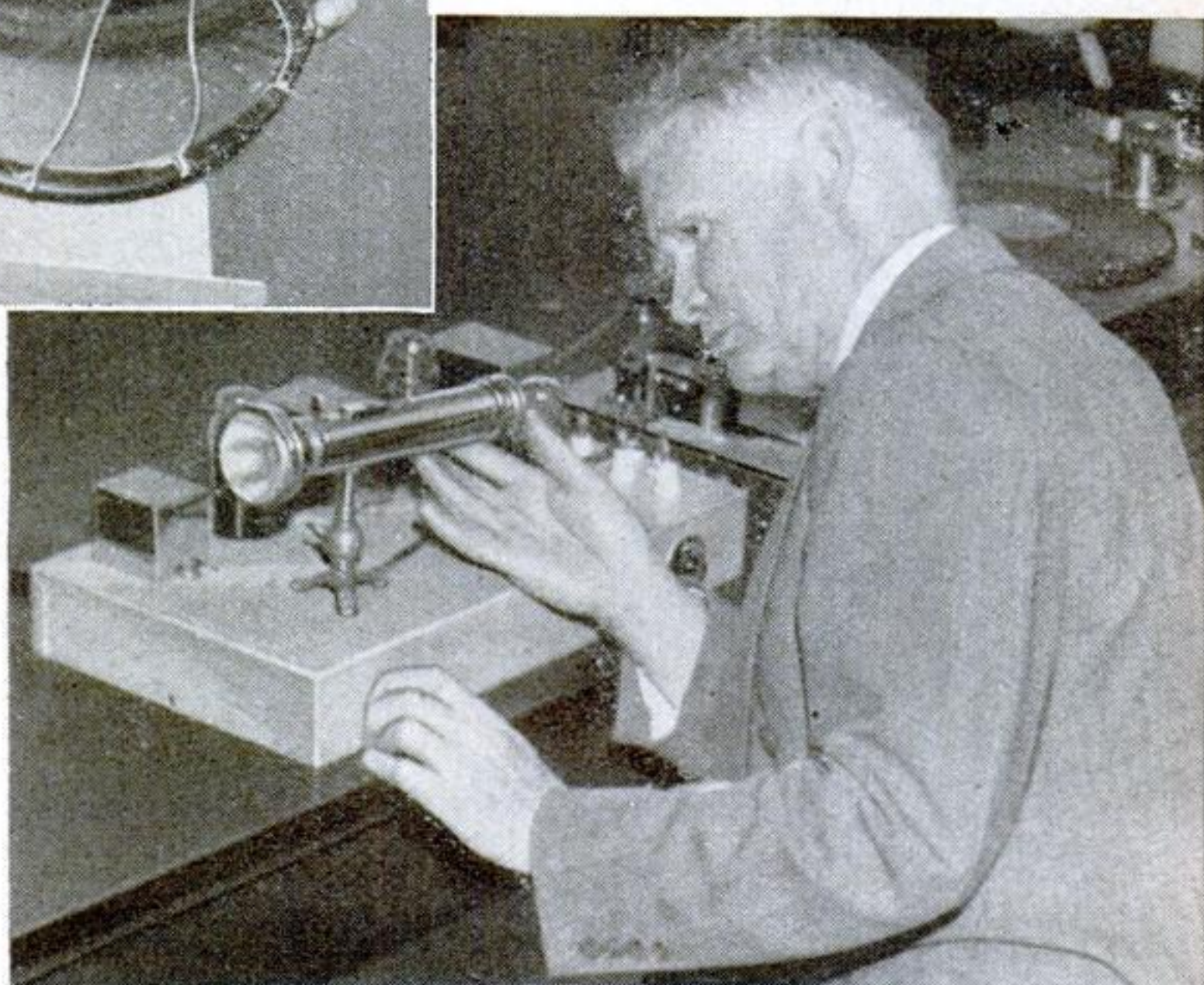
Scientist Talks Over 135-Foot Flash-Light Beam



the bulb filament. A conventional electric-heater reflector picks up the fluctuating light beam and concentrates it on a photo-electric cell, which transforms the light radiations into electric impulses and feeds them to a reproducing apparatus where the original sounds are recreated. Mosteller has talked over the flash-light beam in broad daylight for distances up to 135 feet between light source and receiving unit.

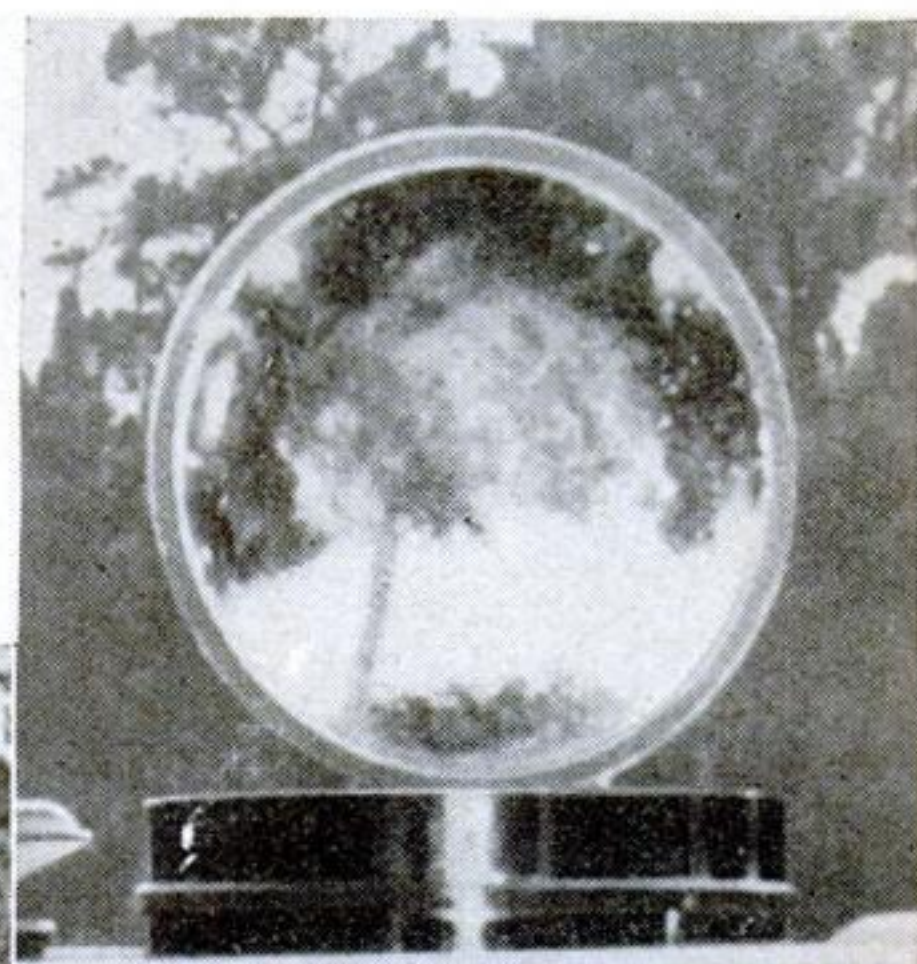
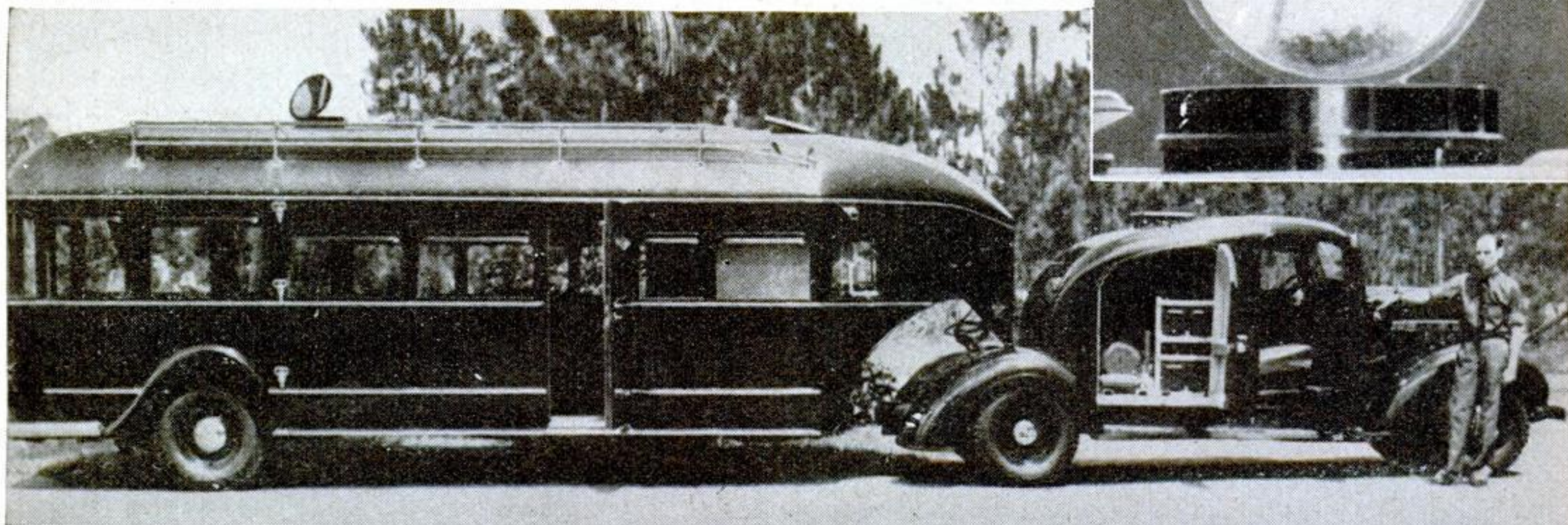
An electric-heater reflector catches light-beam messages sent from a common flash light as seen at the right

AN ORDINARY flash-light bulb provides the light source in a new system of communication in which a beam of light transmits the voice, just devised by G. Mosteller, University of Southern California physicist. Sound picked up by a microphone is transformed into high-frequency electrical impulses that act on

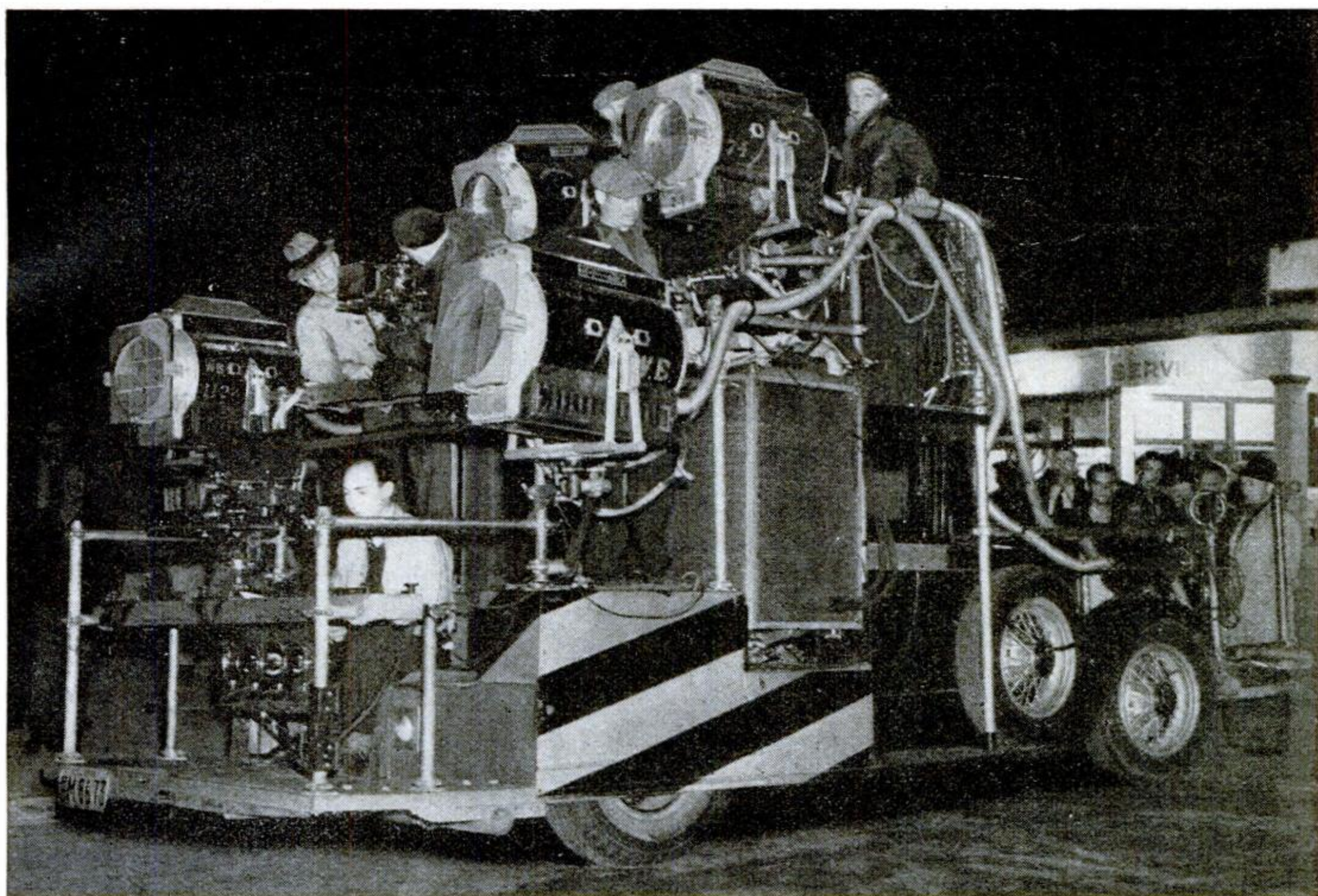


Trailer Carries Iron-Lung Tourist

ALTHOUGH confined within an "iron lung" respirator since he was attacked by a serious illness, Fred B. Snite, Jr., of Chicago, Ill., plans to take a sight-seeing tour of the country in the specially designed invalid trailer pictured below. From his respirator in the trailer, Snite will be able to view the countryside through a group of mirrors and periscopes.



Special trailer built for iron-lung patient. Inset shows one of the mirrors installed for sight-seeing

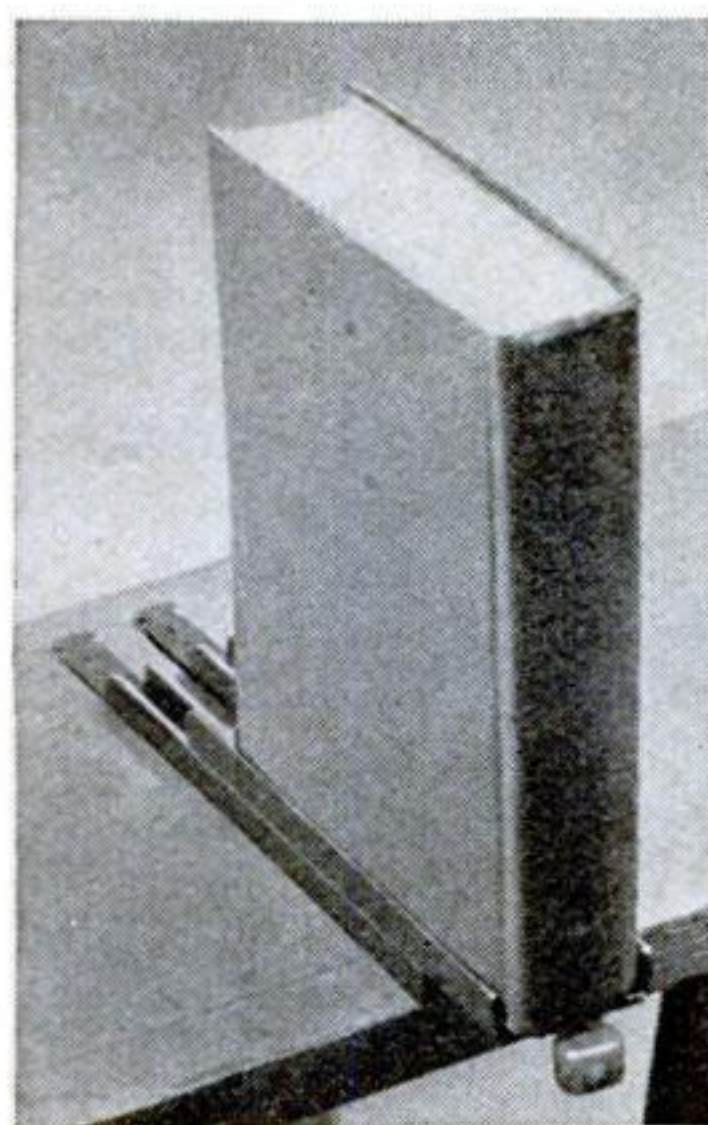


Speedy Camera Car Used in Filming Night Movies

MOTION-PICTURE scenes showing automobiles racing along highways or city streets at night are photographed from the novel camera car shown above. Capable of attaining a speed of ninety miles an hour, the unique vehicle supports a battery of high-powered arc lights drawing current from a generator geared to the car's motor. Flexible

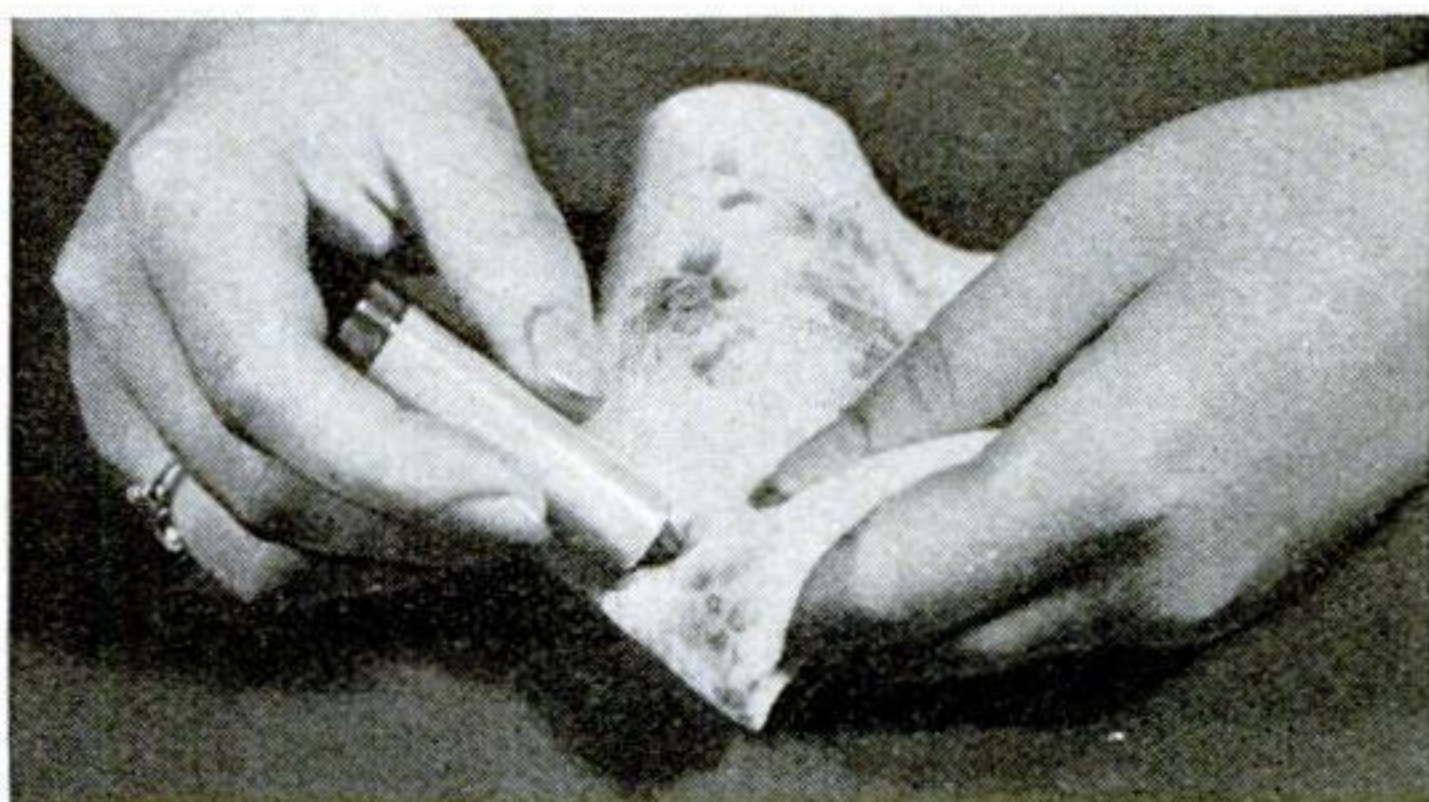
hoses connected to vacuum apparatus suck the smoke from the carbons in the arc lights away from the range of the camera. Camera-men at the rear of the truck talk to the driver by telephone, while colored lights transmit signals to the following cars being photographed. The camera car is rented out by its owner to many Hollywood studios.

Slide Track Saves Books



A finger placed under the tab slides book out

ATTACHED to a bookshelf, a novel mechanical holder makes it unnecessary to grip a volume by its top edge to slide it out from other books, thus preventing book edges from becoming torn or soiled. When a small handle on the accessory is pulled, the book slides out on a moving rail where it can easily be grasped by the back for removal from the shelf.



Novel Face-Powder Holder

CONSTRUCTED in the shape of a conventional lipstick, a new pocketbook container for face powder dispenses a supply when one end is pressed against a handkerchief or powder puff. Available in a large selection of colors, the powder "cartridge" is self-closing, holds a week's supply of powder, and can be refilled.



Daddy's Gone a'Fishing

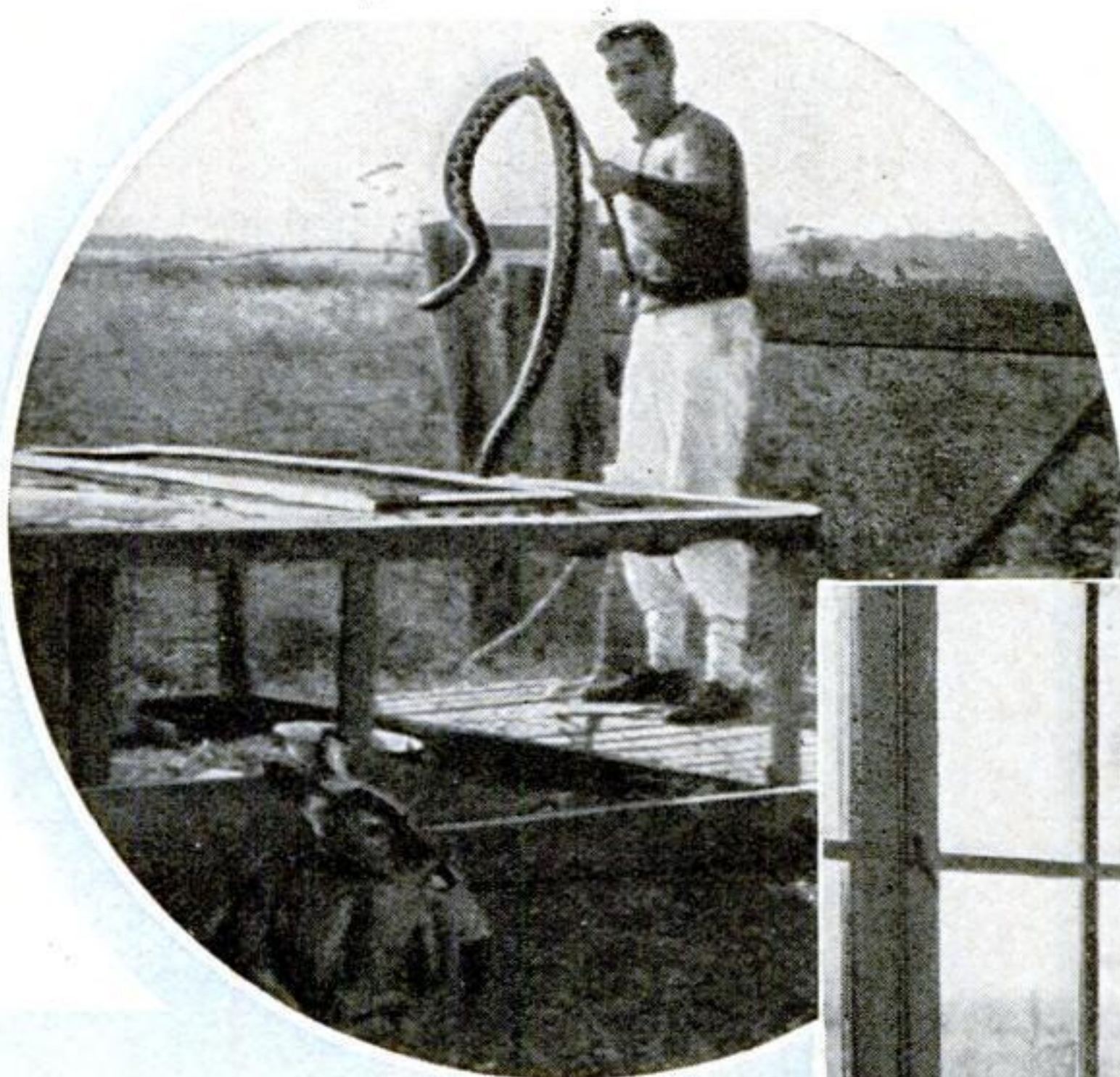
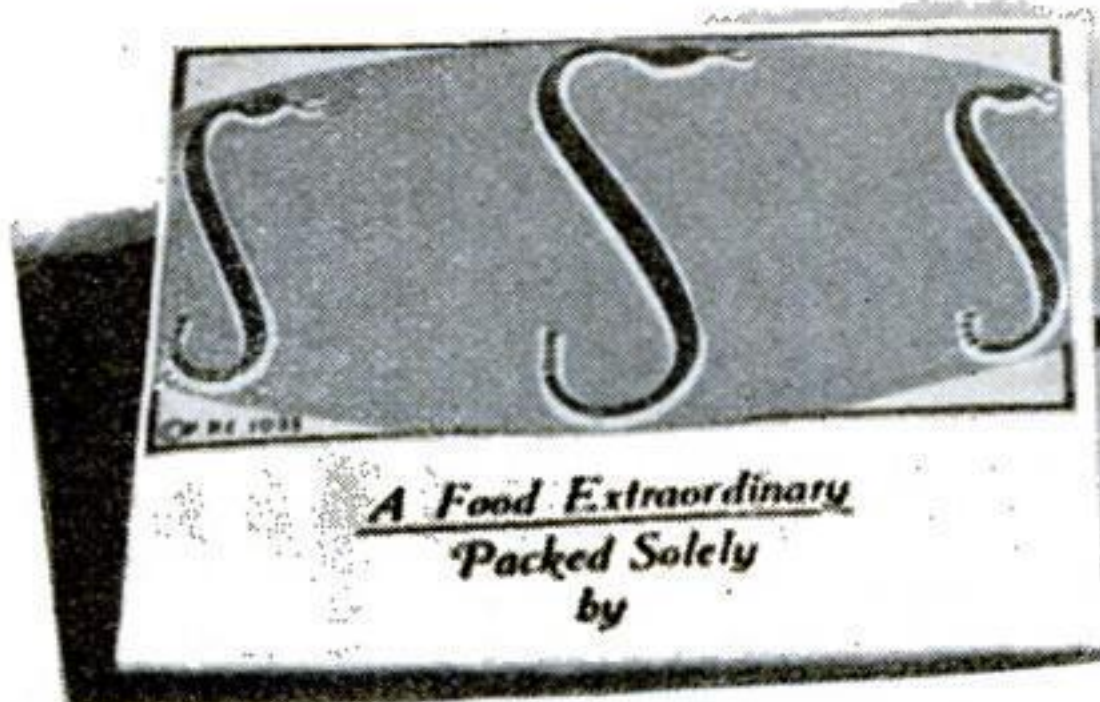
•

MINDING the baby doesn't cramp the style of this Florida angler. With a lightweight canvas seat rigged up to strap on his back, and a parasol attached to one of the shoulder bands, he has both hands free to fish from his perch on a pier in Biscayne Bay at Miami.

How About a Nice Rattlesnake Steak from This Florida Reptile Ranch?

EIGHT miles east of Arcadia, Fla., one of the world's strangest industries is operated by George K. End. He cans rattlesnake meat and ships it all over the world. Orders have come in from as far away as Ireland, India, China, and Australia. The meat, which resembles salmon, is served either hot or cold. So far, End has disposed of more than 10,000 cans. It is served regularly in one Chicago club and it is available on dining cars of a railroad running through the Southwest. Many orders come in by telegraph, and the meat travels to its destination by air mail. In addition to the canned product, End sells "snake snacks," small pieces of smoked rattlesnake "ham." The unique business began when End invested all his money in a cattle ranch near Arcadia during the Florida boom. Diamond-backs killed off his stock as fast as he turned them loose in the palmetto-covered fields. So he began cashing in on the snakes. Besides meat, he sells rattlesnake hides, venom, snake oil, vertebra earrings and charms, and live reptiles.

A can of rattlesnake meat and, below, another product called "snacks"—pieces of smoked reptile "ham"



George K. End, owner of the odd business, handling future reptile cutlets "on the hoof." Below, he is preparing a batch of meat for canning in a big pressure cooker



End has sold 10,000 cans of his product, shipping it all over the world. At the left, he is wrapping cans for mailing

POPULAR SCIENCE

Question Bee

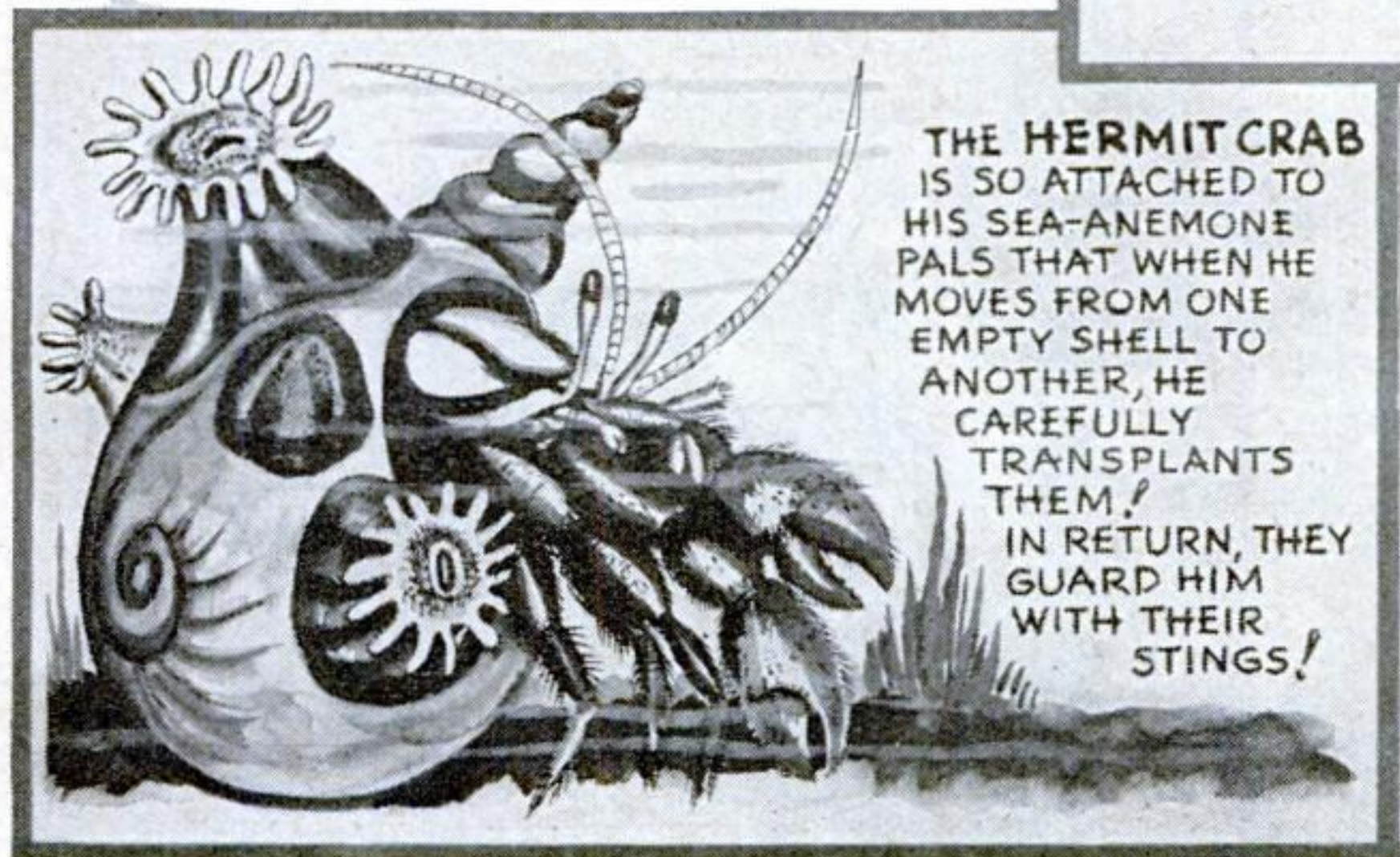
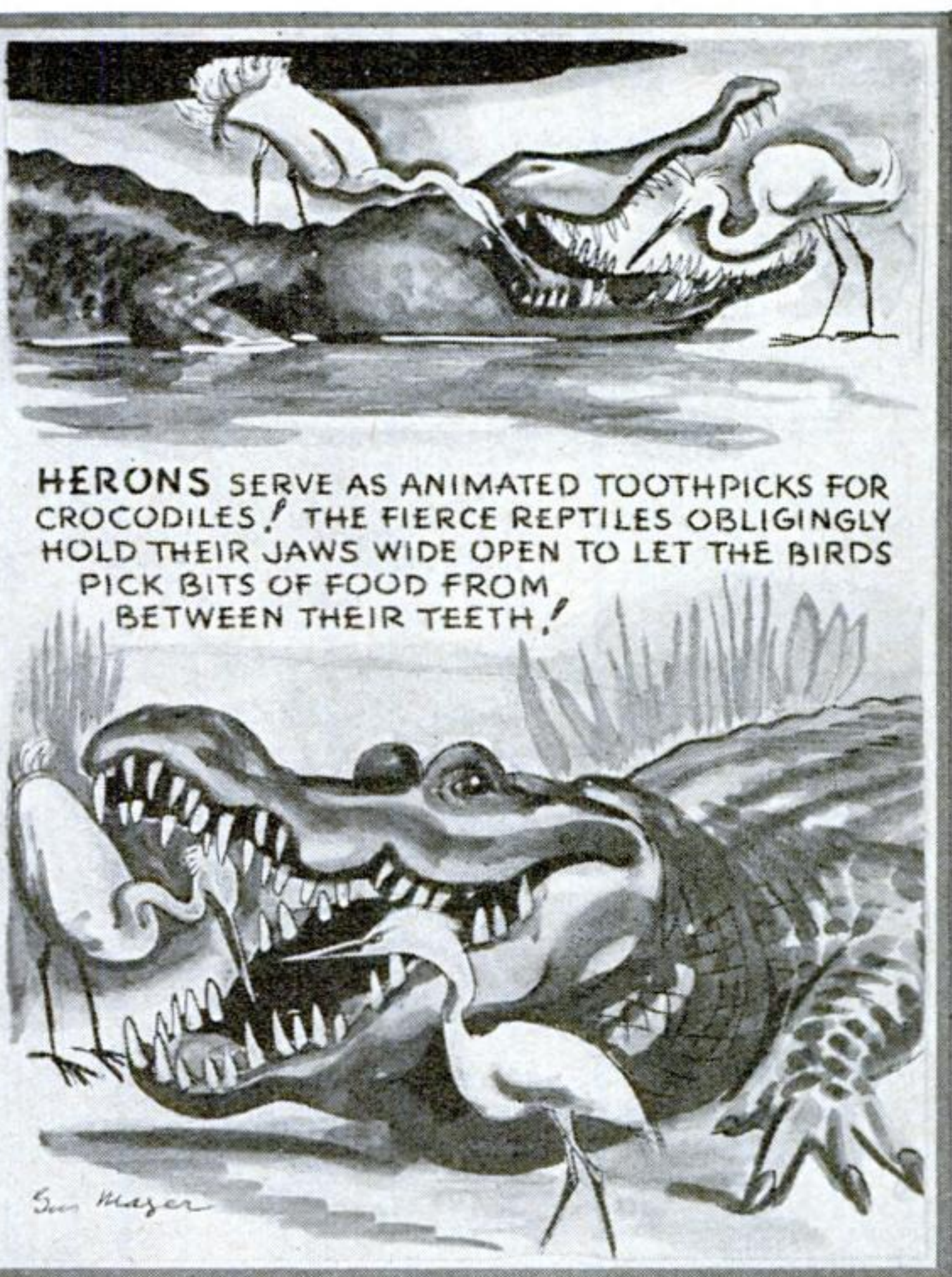
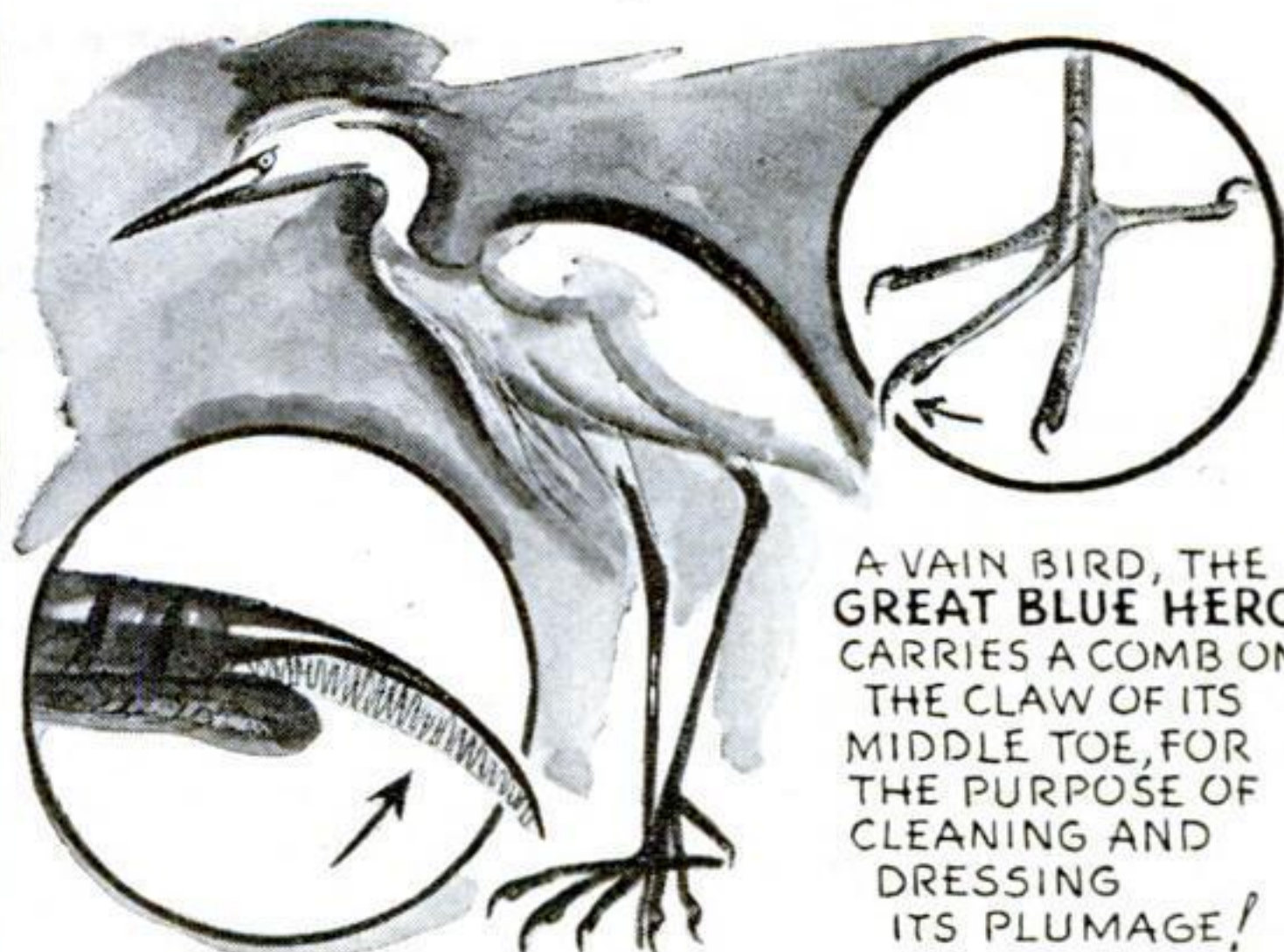
There is just one fact, blended with considerable foolishness, in each of the items below. Jot down the letter corresponding to the answer you select. Then check your results on page 250



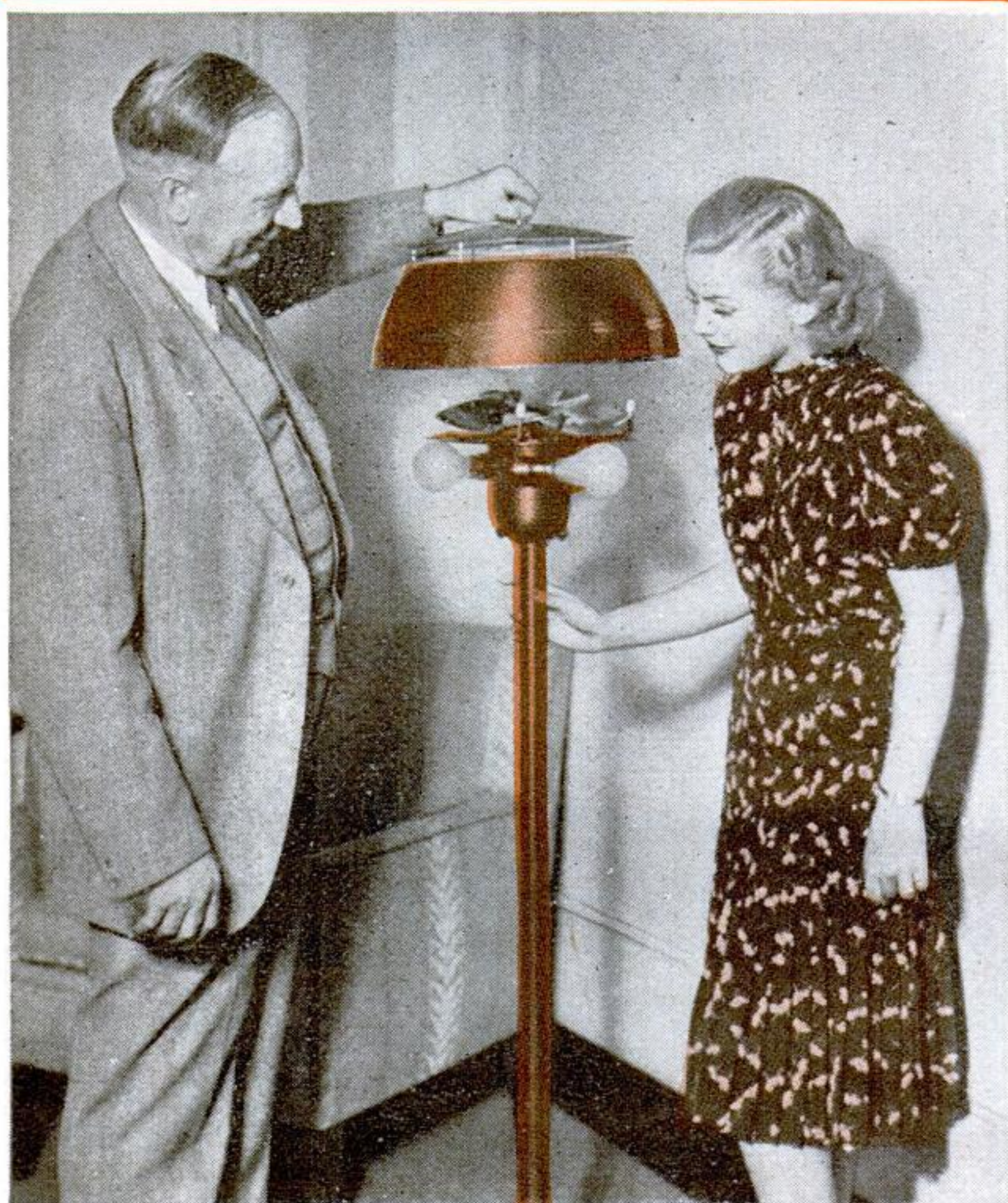
- 1 If you hold a box camera too close to the subject, the picture will be (a) overexposed (b) fogged (c) lacking in contrast (d) out of focus.
- 2 Amnesia is (a) a wholesale pardon for political prisoners (b) a shrub bearing handsome yellow flowers (c) loss of memory (d) a mineral used for heat insulation on steam pipes.
- 3 Warships attack enemy submarines with (a) space charges (b) depth charges (c) booster charges (d) cover charges (e) cavalry charges.
- 4 It is customary to mark the positive terminal of a piece of electrical apparatus with a (a) five-pointed star (b) swastika (c) broad arrow (d) plus sign (e) zigzag symbol of a thunderbolt (f) skull and crossbones.
- 5 One of the most poisonous snakes of this hemisphere is the deadly (a) fleur-de-lis (b) mal de mer (c) fer-de-lance (d) pomme de terre (e) chemin de fer.
- 6 If two sides of a three-sided figure are equal, it is called (a) a scalene triangle (b) an isosceles triangle (c) a spherical triangle (d) an eternal triangle.
- 7 "Stannic" means (a) divided into stanzas (b) related to tannic acid (c) obtained from stones (d) containing tin.
- 8 To revive a person who has nearly drowned, it is often necessary to apply (a) hydrotherapy (b) artificial respiration (c) a tourniquet (d) antitetanus injections.
- 9 The Jukes are (a) a popular team of radio entertainers (b) the only living descendants of the Vikings (c) a turbulent minority of a central European country (d) a celebrated family of imbeciles and criminals to whom students of heredity have given this fictitious name.
- 10 Electricity is measured in units named after (a) Greek gods (b) signs of the zodiac (c) scientists (d) musical notes.
- 11 A diet that is lacking in vitamin B, such as one consisting largely of polished rice, often leads to (a) hara-kiri (b) beriberi (c) jujutsu (d) gutta-percha (e) mah jong.
- 12 In a vault at Paris, France, reposes a bar of precious-metal alloy known as the (a) standard meter (b) gold standard (c) standard of living (d) double standard.
- 13 Pairs of hues like red and green are called (a) primary colors (b) complementary colors (c) interference colors (d) tempera colors.
- 14 Scholars have tried to devise languages that will be understood everywhere, of which the best-known is called (a) Esperanto (b) Doric (c) Pictish (d) Anzac (e) Futura.
- 15 "Vapor lock" is the name given to a (a) time lock operated by the evaporation of a volatile liquid (b) cause of trouble in gasoline motors (c) chamber for entering and leaving a gasproof air-raid shelter.
- 16 You don't need a lens if you use a (a) reflecting camera (b) miniature camera (c) view camera (d) pinhole camera.
- 17 The symbol that chemists use for sodium is (a) S (b) pH (c) Na (d) CQ.
- 18 To find out how deep the water is, sailors (a) open the sea cocks (b) shoot the sun (c) heave the lead (d) splice the main brace.
- 19 A diopter is (a) a realistic model of a scene (b) a flying machine that can ascend vertically (c) the power of a lens that has a focal length of one meter (d) a beautiful microscopic plant.
- 20 Copper sulphate is also known as (a) rhinestone (b) moonstone (c) loadstone (d) rottenstone (e) bluestone.

Un-Natural History

By
GUS MAGER

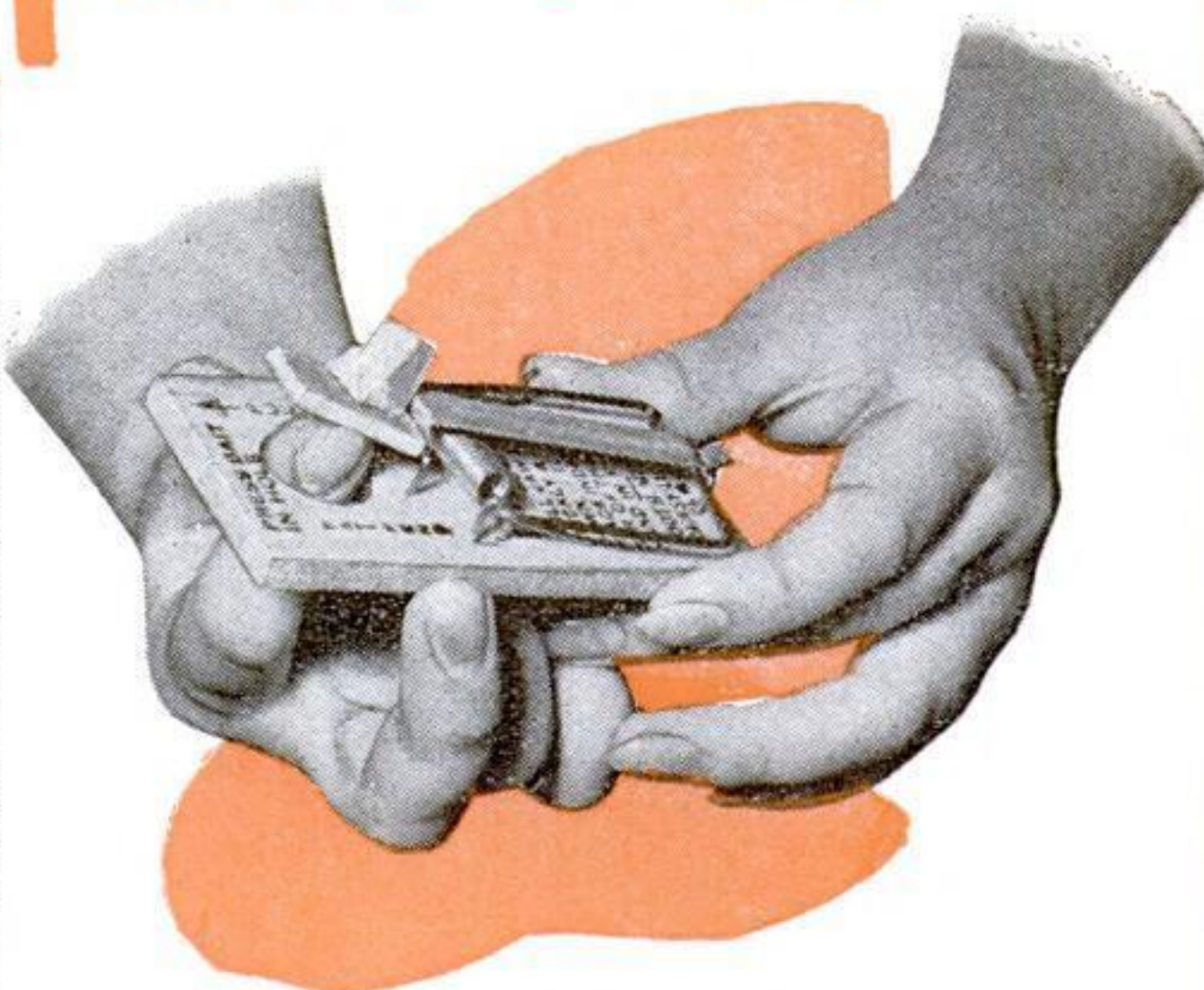


New Appliances

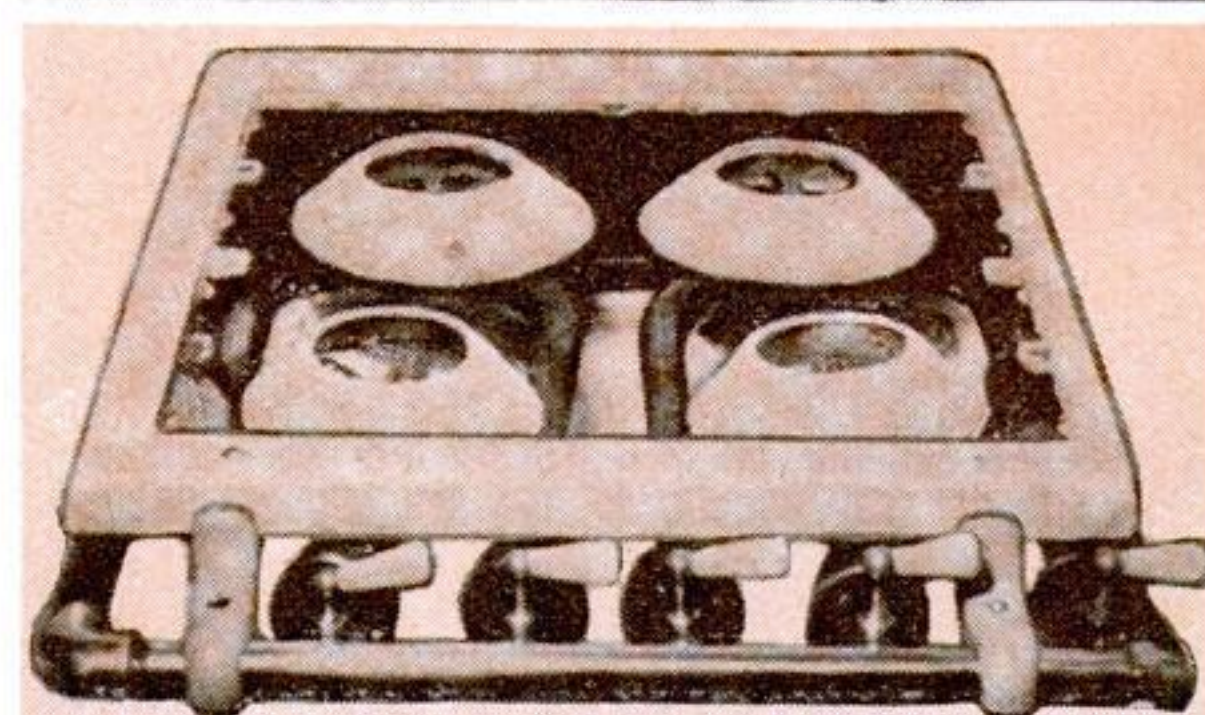


COMBINATION FLOOR LAMP

Although it looks like an ordinary floor lamp, this lighting fixture boasts a built-in electric fan and a special insect trap



PINCHPROOF MOUSE TRAP. There is no risk of pinching the fingers in setting the safety mouse trap pictured above. A hole in the base makes it possible to push the bait holder into place from below



GAS-BURNER COVER. Placed over the burners of a gas stove, asbestos covers concentrate the heat and are said to effect considerable savings in fuel bills. It is also claimed that they prevent overheated kitchens

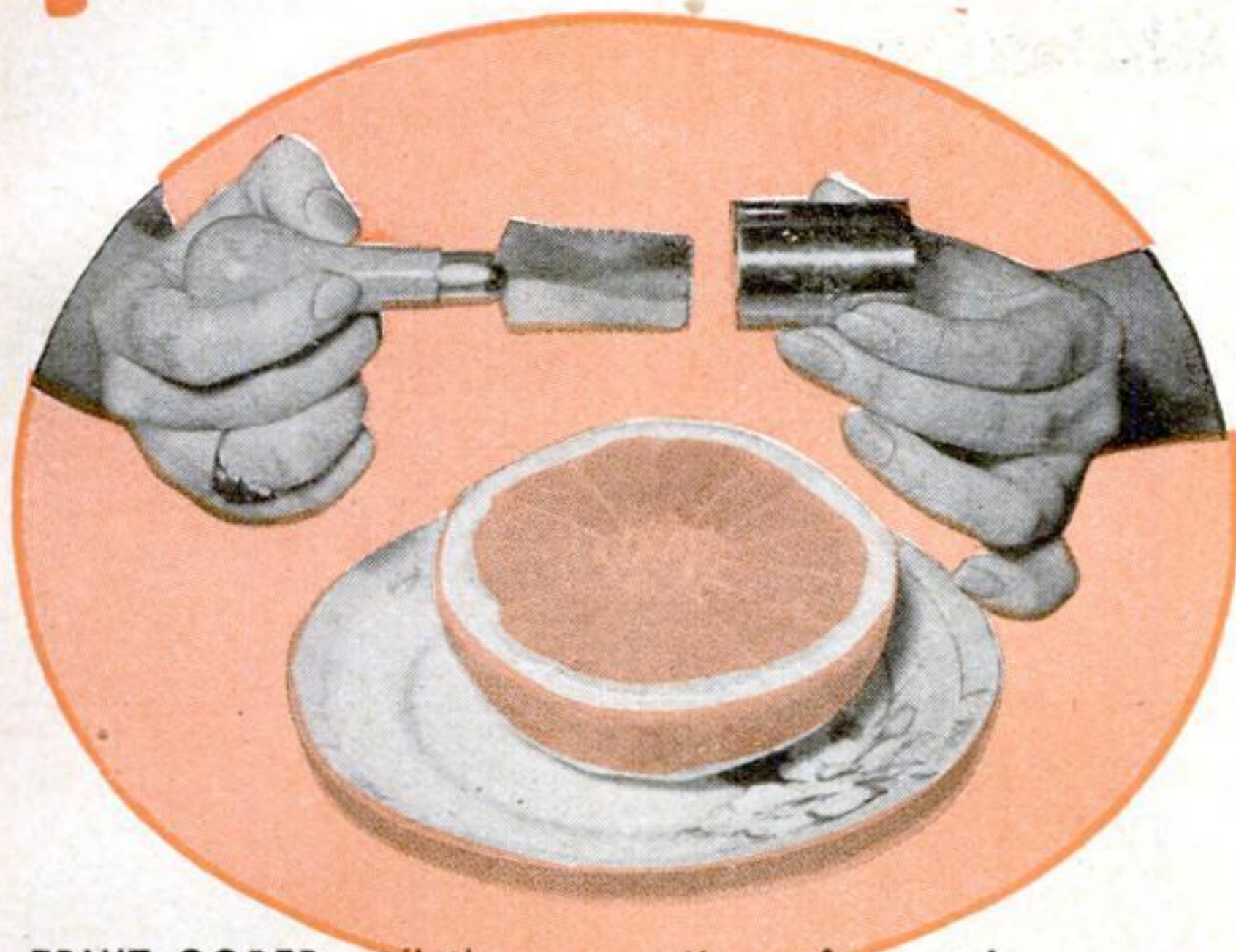


JUICER-MIXER

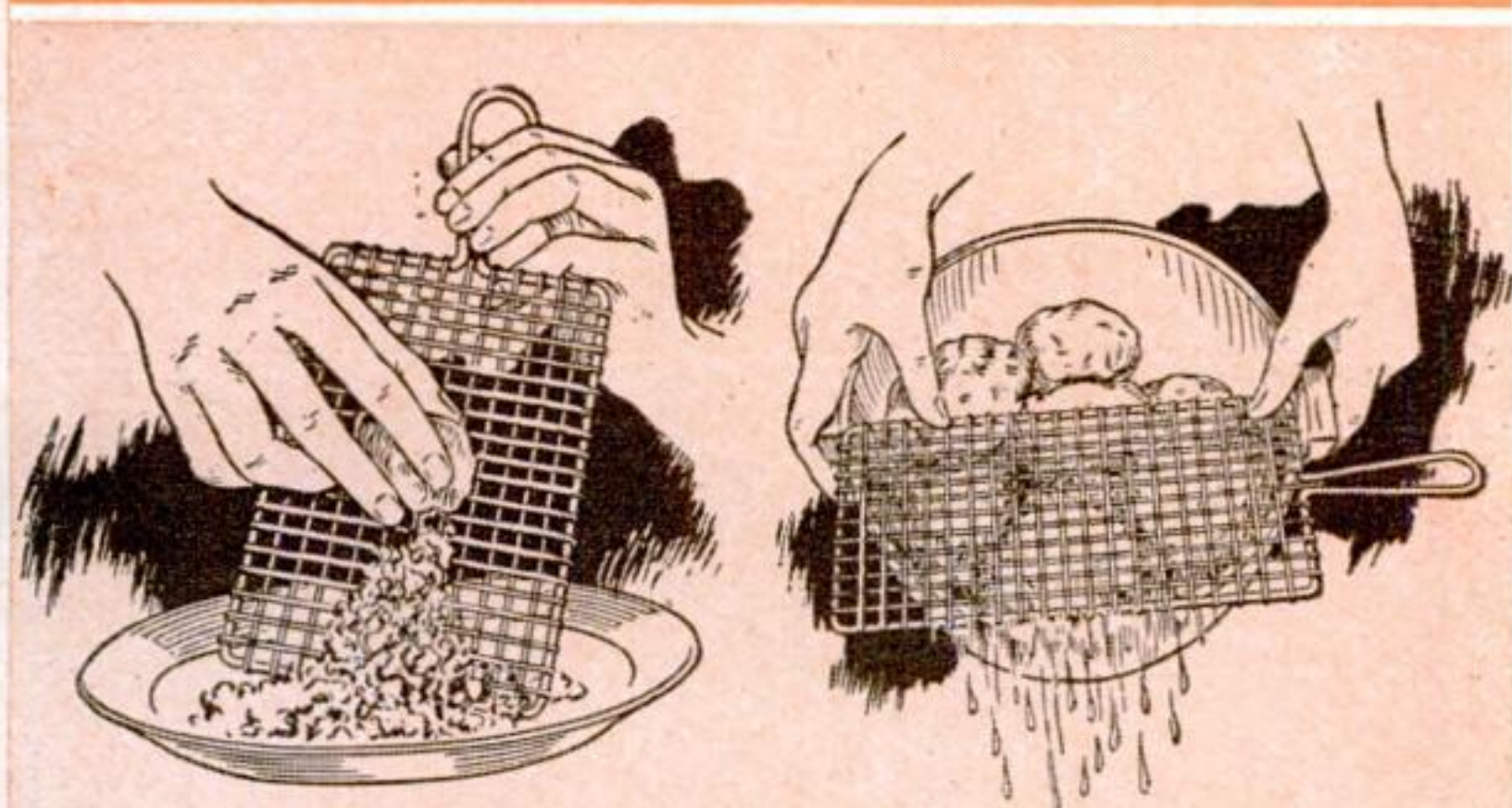
Fruits, vegetables, and meats are reduced to tiny particles and mixed into beverages or liquid dishes by the motor-driven agitator of this electrical device



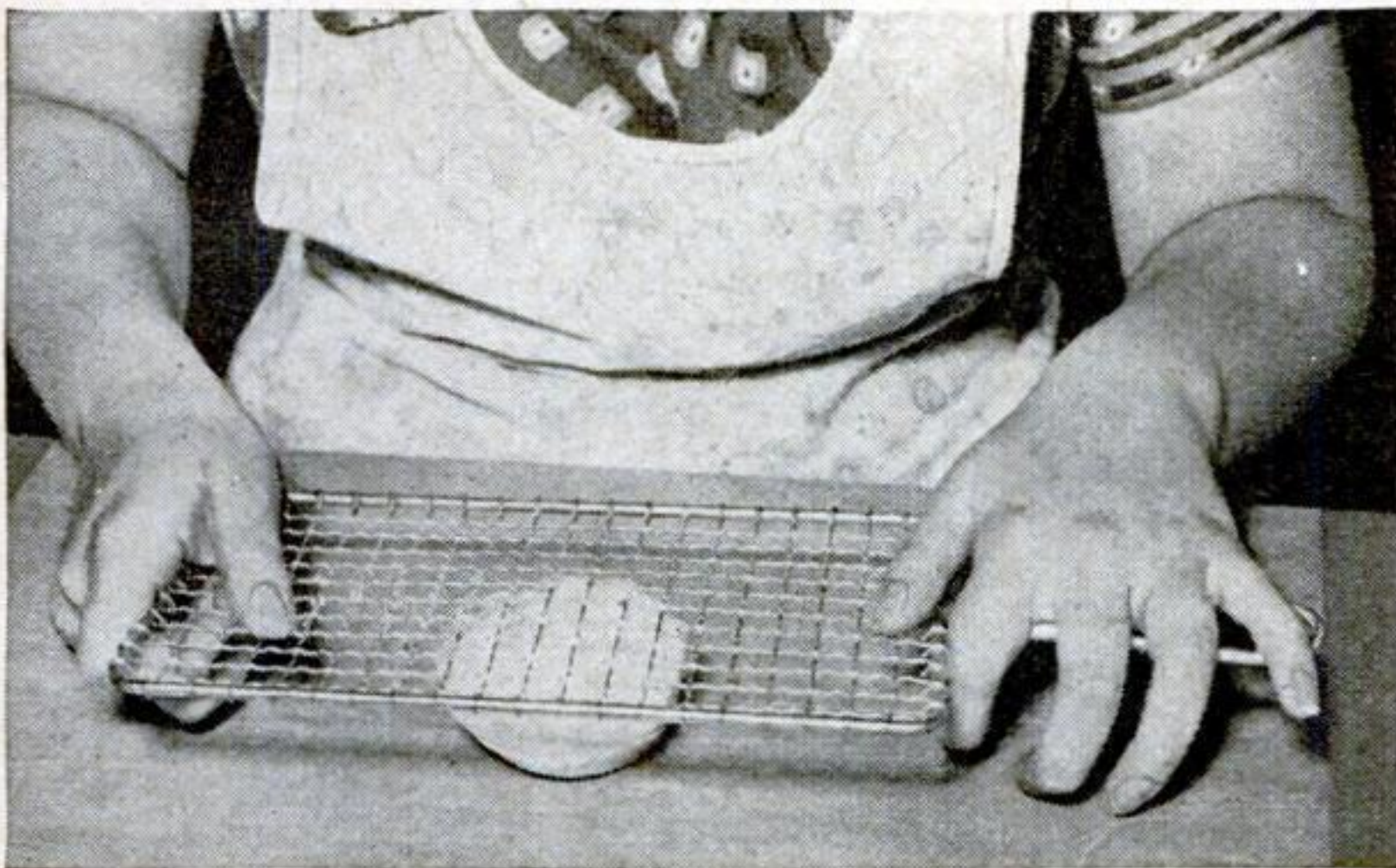
for the Household



FRUIT CORER. All three operations of preparing grapefruit are performed by an improved fruit corer. The tubular bottom takes out the core, while a removable knife blade sections the fruit and separates the meaty part from the rind



FOUR-IN-ONE GRATER. Besides being useful for grating and dicing fruits or vegetables, this handy tool can be used as a strainer, as illustrated in one of the drawings. It also serves as a cooling rack for cakes, permitting free circulation of air



VERSATILE SHOWER CURTAIN. Made of fluffy, water-repellent material, a new shower curtain may also be worn as a beach cape as shown above, and serves equally well as a beach towel. It comes in an oiled-silk envelope for convenience in use at the shore

GUS GIVES A WATER CURE

GUS WILSON, busy in the shop of the Model Garage, heard the telephone in the office ring, and Joe Clark, his partner, answer the call. Then Joe called to him.

"Hey, Gus! Job for the tow car. Fellow in a black coupe, in front of Johnson and Frederick's factory. Says he's run his battery down trying to get started, but can't get his engine to turn over. Have to pull him in."

"All right!" Gus shouted back at him. Then he turned to Harry, the promising young mechanic.

"You go get him."

Twenty minutes later he heard the tow car stop outside the shop door, and went out to see what particular variety of grief it had dragged in.

Seated in the towed coupe was a business-like-looking young man with a puzzled expression on his face. Gus's quick glance took in a pile of advertising literature on the ledge back of the seat, which confirmed his impression that the new customer was a salesman.

"Hello," he said cheerily. "What's wrong?"

"You tell me!" the young man replied, getting out of his car. "My bus ran all right this morning. But when I came out of Johnson and Frederick's, where I'd been for a couple of hours figuring a job, and stepped on the starter—nothing happened. I kept on stepping on it, but couldn't get the engine to turn over. You know how it is—you keep thinking that the next kick will do the trick, and then the first thing you know your battery's down. Mr. Johnson came out just then, and suggested that I phone you."

"He's a customer of ours," Gus said. "No trouble with your car lately, eh?"

"Two or three mornings ago," admitted the

young man, "it gave me a battle before I got it started. Couldn't get the engine to turn over—pretty much like today. But after a dozen or so tries she began to buzz, and I didn't have any more trouble until this afternoon. I know a little something about electricity—sell electrical fixtures—so I checked up on the wiring. It seemed O. K."

When the car had been rolled into the shop, Gus raised the hood, sniffed a few times, and then uncapped the radiator filling pipe and squinted down it. "Water seems a little low," he remarked. "Better fill her up, Harry." He turned to the customer. "Been using any more water than usual, Mr.—Mr.—?"

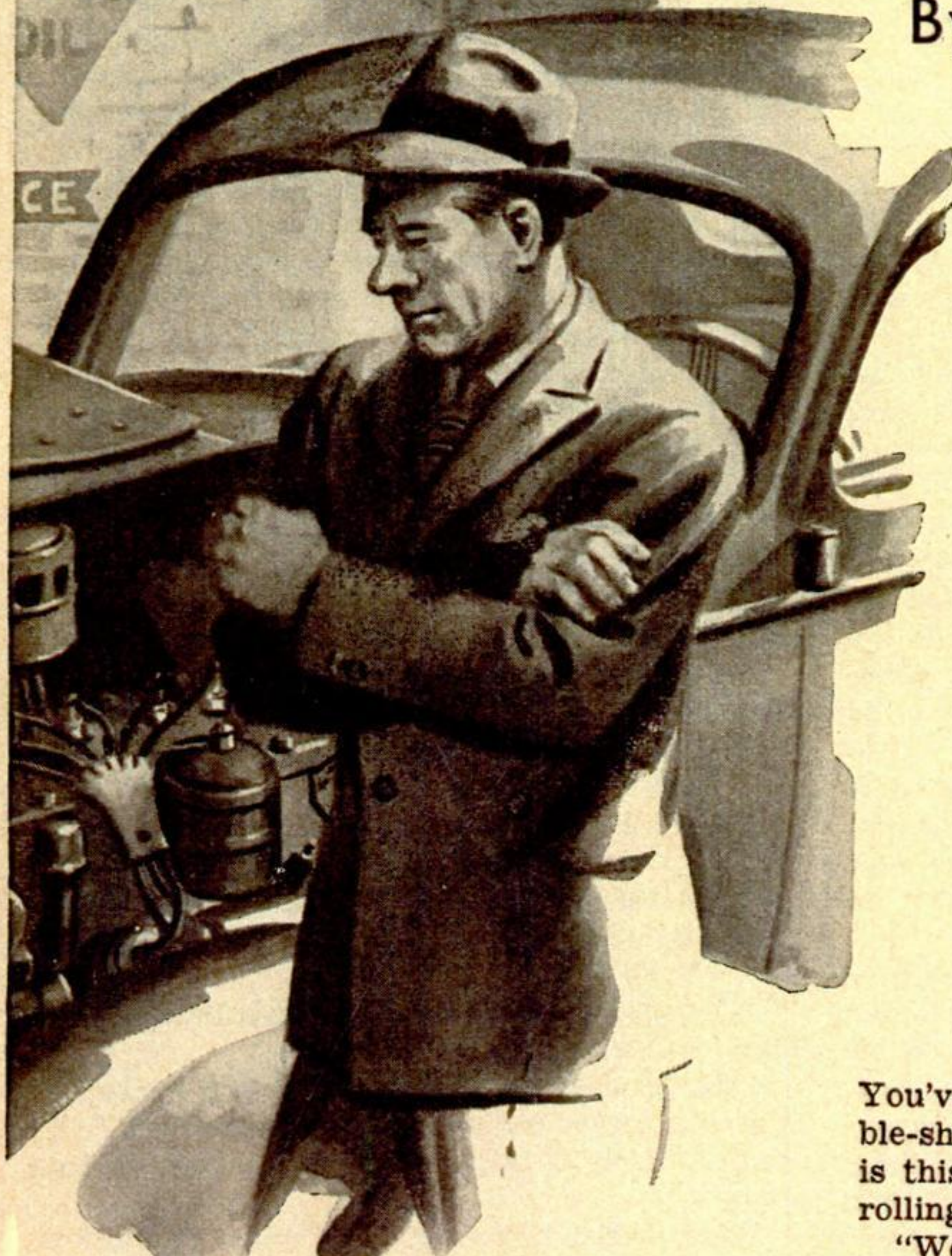
"Joe Kent is my name," the young man said. "Yes, now that you mention it, I think that for the past week or so I have been using a little more than I usually do."

Gus hummed tunelessly under his breath as he watched Harry hose a quart or so of water into the filling pipe.



Gus raised the hood, and then uncapped the oil dipstick and squinted down it. "Low," he remarked.

By MA



Harry—

When Gus peered under the hood, he saw a puddle of water under the car. "Water jack," he said. "You got a water jack?" Kent—you too, something that I use very often. See how I get your engine to start, Kent? When you were with Frederick's, it was your engine stopped on the piston of this cylinder on its compression stroke. When we were in there, the cylinder was full of water. When I stepped on your starter, the force of the water in the cylinder kept the piston from moving, naturally the engine couldn't start.

"Well, that's a new one and I've driven quite a few miles," Kent admitted. "I've even heard of it."

"You've lived up to your reputation as a shooter, Mr. Wilson—but, is this job going to take? Can you get it rolling in an hour?"

"We sure can," Gus said. "I'll put in a new gasket, drain your car of the heck of a lot of water in it now—drain the engine, and fill her up with fresh oil. It won't be more than an hour doing this. Step into the office, and my partner will be with you comfortable while you're waiting. I might even use your time trying to sell you a couple of desk lamps—goodness knows you need them!"

"What I don't understand about this," Harry said, as he started to fit a new lined copper gasket, "is how he could get the car started the other morning, when it couldn't get it started today."

"That's easy," Gus told him. "Probably this old gasket has been leaking for a couple of weeks or so. This Kent isn't a very bright sort of fellow, or the performance of his engine would have put him wise to the fact that there was a compression leak in the cylinders. But the water that leaked into this cylinder from the water jack affected the starting of his car except

"Ever notice any white vapor coming out of the exhaust?" was his next question.

"Haven't noticed it," said Kent.

"Or water on your garage floor?" asked Gus.

"Well, I've noticed a little water on the floor now and then," Kent replied, "but I never bothered to see where it came from."

Gus pulled out the bayonet-type oil gauge and peered at it. Then he looked at Kent and grinned. "Your trouble isn't very serious," he said. "Just a blown cylinder-head gasket."

"Cylinder-head gasket?" echoed Kent. "Why, what has that to do with my not being able to get started?"

"I'll show you," Gus assured him. He began to take out spark plugs, looking closely at each before he laid it aside. After he had examined the fourth, he held it out and Kent saw that several drops of water glistened on it. "This cylinder is the baby that's making all the trouble," Gus told him. "Come on,



arter, nothing happened that I phone you."

ust as the piston of as starting its com- a let the car stand der to get pretty well

appened when he had his w mornings ago. But that made it possible for him to r a while.

he things was that the cylinder tely filled with water—probably piston had partly completed its stroke when he had cut off his e other was that he had a good, ery. Every time he stepped on the ne piston would advance a little he water cushion, and force a little ater out of the cylinder. It happened ore he had run his battery all the way he had forced out all of the water, so ine started. Savvy?"

y nodded. Gus watched him closely eaned the faces of both the cylinder der block thoroughly, fitted ully, and replaced the head. d for a moment, then went and returned with a diagram sulted before he replaced and ten the cylinder-head stud nuts. ed approval. "I'm glad you re- hat," he said. "It's always a good nten those stud nuts in the order manufacturer recommends. If the cturer doesn't recommend any par- order, start with the nuts at the cen- he head and work outward, tightening ners last. Draw the nuts down snugly, tightly. Then go over them, in the rder, a second and a third time. Be get all the nuts to the same degree of s. If they are uneven the result may expensive—a cracked head or even a dis- ed cylinder block. After the engine has run long enough to get it thoroughly ed up, tighten them again. And tell stomer to bring his car back after he a it for a few hundred miles, so that give them a final tightening."

t!" Harry said, as he went on with "Here's another thing, Gus—is there for water to get into a cylinder ex- ough a leaking gasket?"

"Yes, there sure is," Gus told him. "As a matter of fact, first off I thought this was something else. Then I put two and two together and decided it couldn't be."

"Couldn't be what?" asked Harry.

"Couldn't be a cracked cylinder. You see, when a cylinder cracks, it's usually at a point where it's been weak for some time, and when it goes, it goes. That lets in more water than just a tiny gasket leak, and multiplies the troubles that Kent's been having, many times."

"Suppose that spark plug hadn't been wet, and you couldn't see signs of moisture in any cylinder. How would you make sure that there was a leak?" ask the mechanic.

"That's not so hard," replied Gus. "First, fill the radiator right up to the top. Then run the motor until it is thoroughly warmed up. Shut the motor off and crank it slowly by hand. As the piston comes up on the compression stroke in the cylinder that's got a leak in it, it'll force air through the place where the leak is into the water jacket. If you squint down the radiator filler opening you'll see air bubbles if you watch closely."

"Gosh, Boss!" Harry exploded. "You sure do know all the answers!"

"Wish I did," sighed Gus, modestly.

Kent's car was ready on time, and he hurried on his way. Gus made out a time-and-material slip on the job, and took it in to Joe Clark.

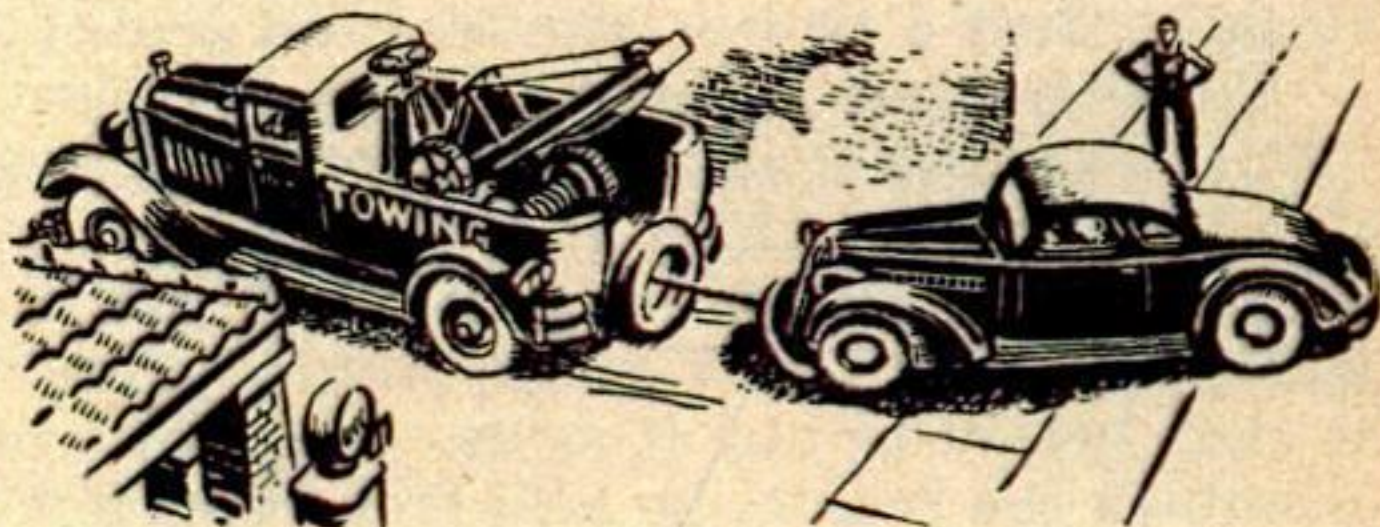
"Ordered a couple of new desk lamps from that fellow," Joe said.

Gus grinned at him. "Soon as I looked at Kent, I knew he was a real salesman," he said. "Well, I guess he got the best of this deal."

Harry had followed him into the office. "Say, Gus," he demanded, "how did you get wise to the fact that Kent's trouble was caused by water in one of the cylinders?"

"Saw a few drops of water on the floor under his car after you got it into the shop," Gus said. "It pays to use your eyes in this business, son!"

"It sure does," Joe Clark agreed. "You said Kent got the best of this deal, Gus. I'm not so sure about that. I used my eyes too—saw that his tires weren't so good, and sold him a couple of new ones!"



When he heard the tow car stop outside the shop door, Gus went to see what grief it dragged in

THE HOME WORKSHOP

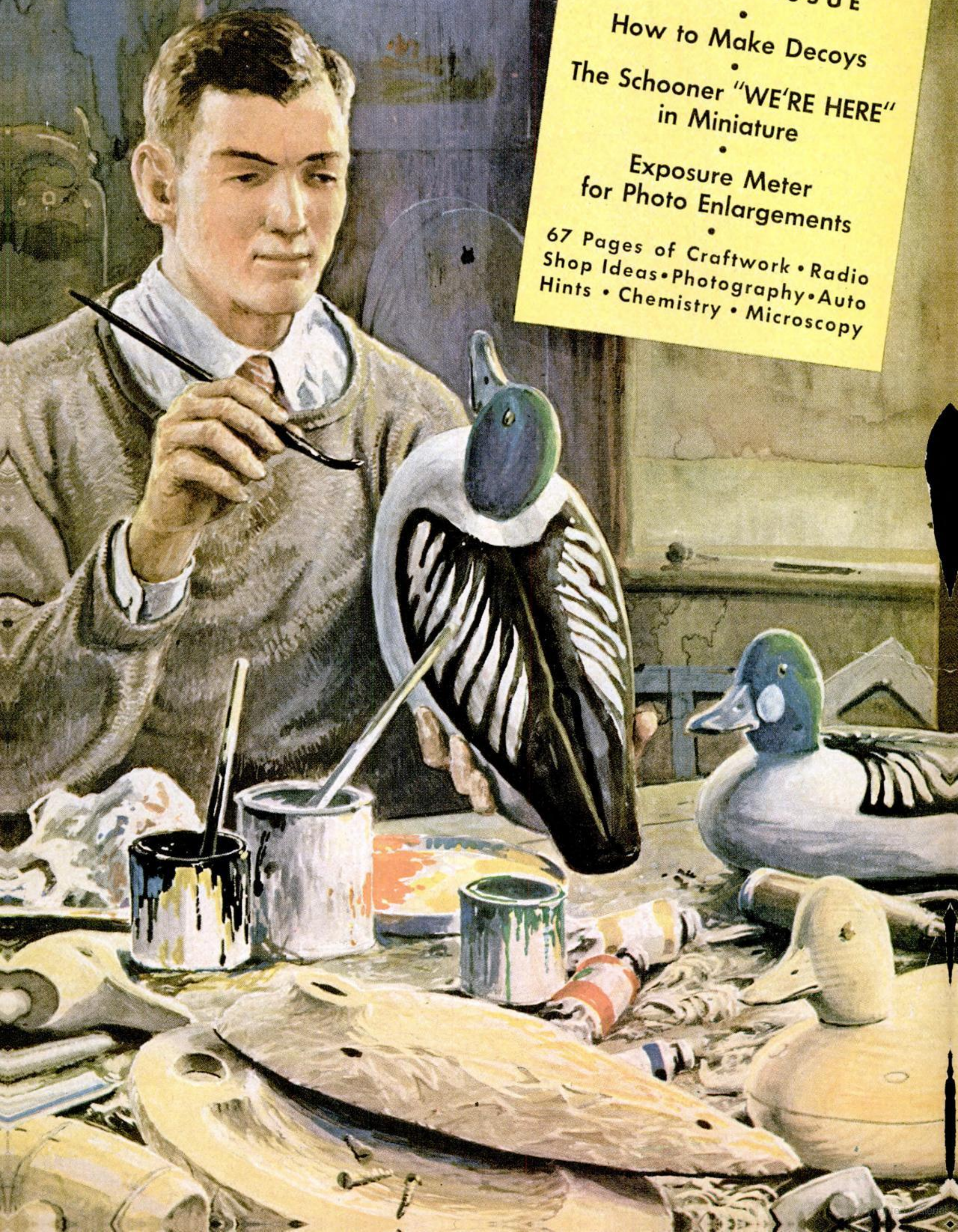
IN THIS ISSUE

•
How to Make Decoys

•
The Schooner "WE'RE HERE"
in Miniature

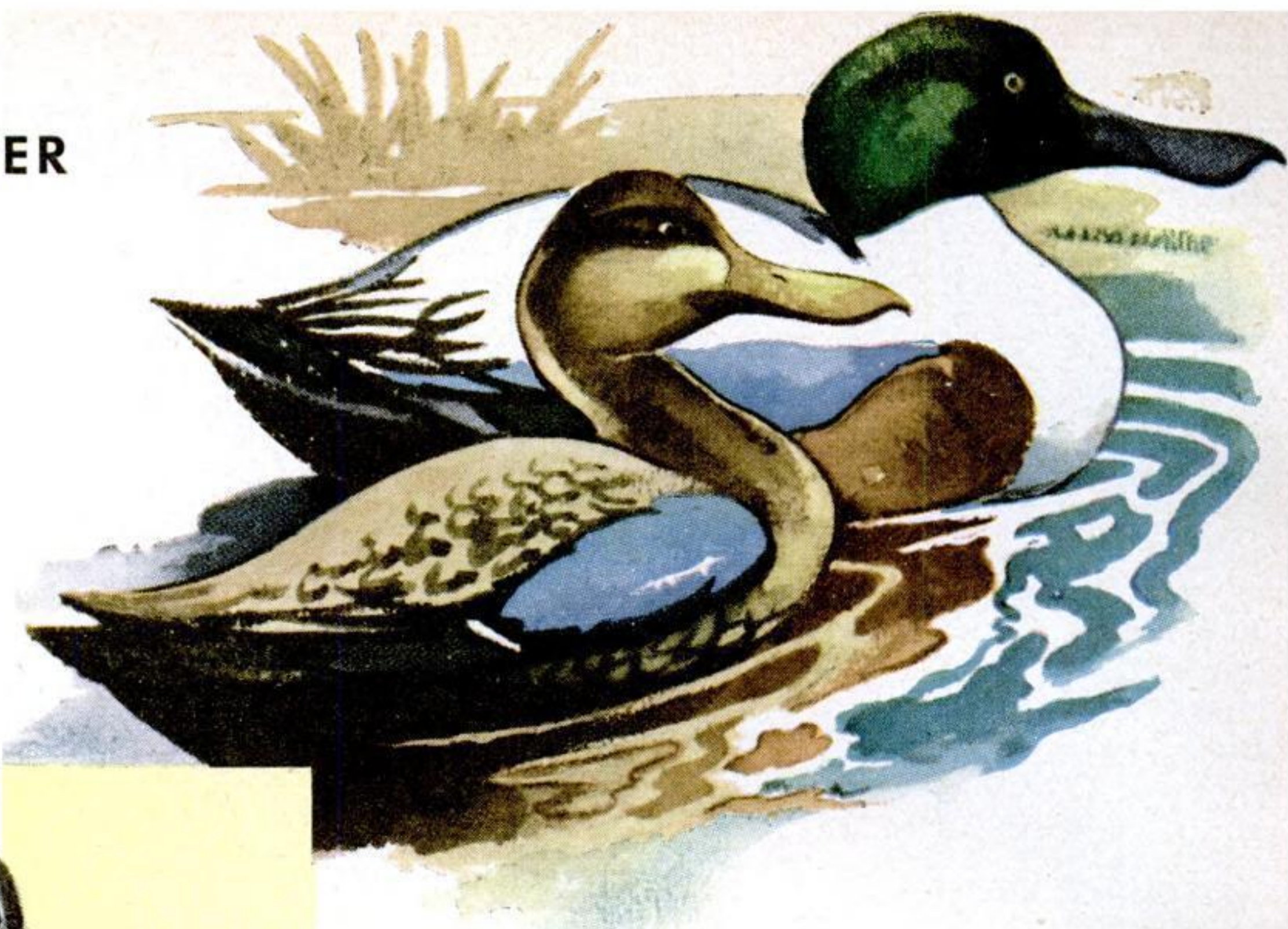
•
Exposure Meter
for Photo Enlargements

•
67 Pages of Craftwork • Radio
Shop Ideas • Photography • Auto
Hints • Chemistry • Microscopy



By
WILLIAM H. FOSTER

The shoveller duck or spoonbill, as it is commonly called. On the preceding page Mr. Foster has shown the coloring he uses for whistler decoys. Below, how the body is roughed out with a hatchet



Realistic WOODEN Decoys

WOODEN decoy making gives special satisfaction to those who like to construct their own articles of sporting equipment. In duck shooting there is no such thing as too many artificial decoys because the bigger the display of decoys, the bigger the flock of wild birds it will attract. Singles and pairs may swing in to half a dozen artificial decoys, but a flock of ten, generally speaking, rarely does so.

These decoys have removable, interchangeable heads. The bodies can be packed much like stove wood, and the heads are carried separately in a box or bag. Any head, picked at random, will fit any body.

The first step is to get out a full-size working drawing. Decoys should be at least as large as the species of duck they are made to imitate. For practical purposes, in fact, they should be larger so as to be more easily seen at a distance. A twenty-five percent oversize seems to work out about right.

The chief difference in decoys to represent certain species lies in the shape and relative size of the heads. The canvasback has its high-crowned

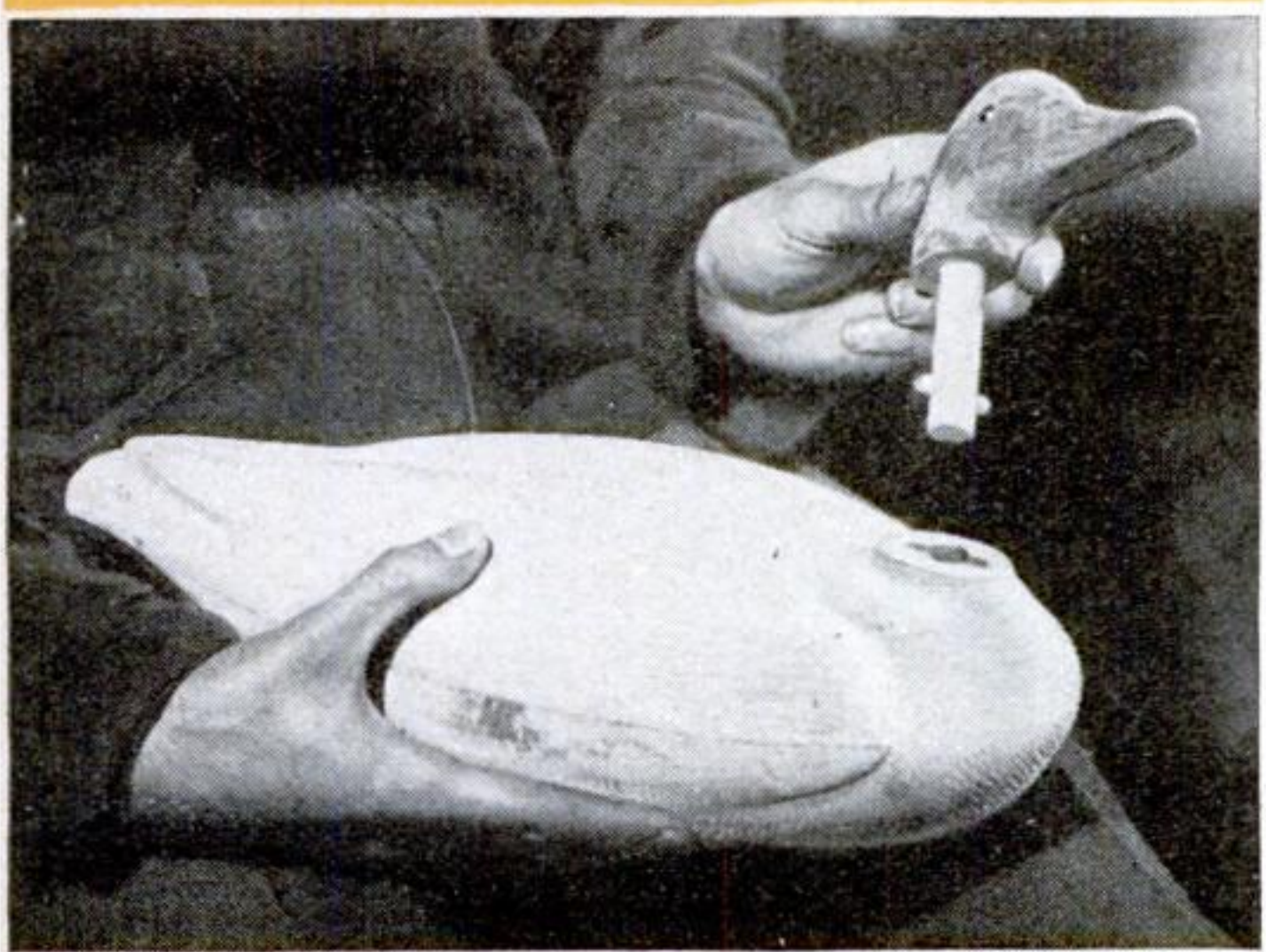
The two-piece bodies are hollow, and the heads can be instantly removed for convenient transportation

head and long, roached bill. The pintail, black, and mallard have more gracefully arched heads with bills of normal length. Whistlers (American golden-eye) and bluebills (scaup) have puffer, thicker heads and shorter bills. Coot (scooters), not being especially fussy with whom they associate, will usually decoy to anything that is not overcolored. In getting out the working drawings, therefore, it is well to study the illustrations in reliable bird books or mounted museum specimens. The construction drawings are of a black duck; the painting reproduced on page 159 shows American golden-eyes or whistlers.

The accompanying drawing shows a body 15" long—a good, conservative size. The width is 7½". Plenty of breadth and a low center of weight are essential.



After the body blanks are band-sawed, each is hollowed with a 1" chisel or gouge and a mallet



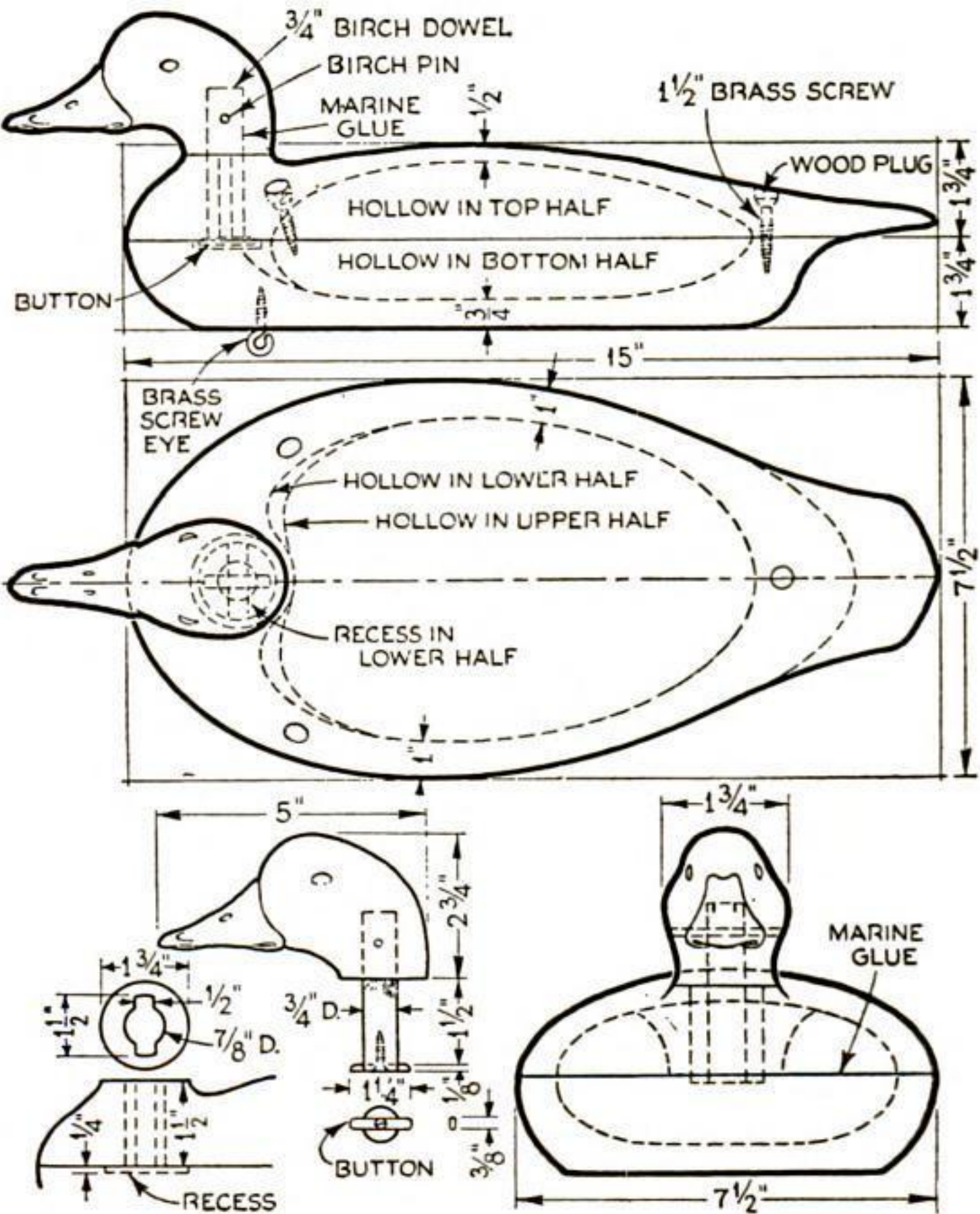
Inserting the head, which is locked in place by giving it a quarter turn. At right, the drawings

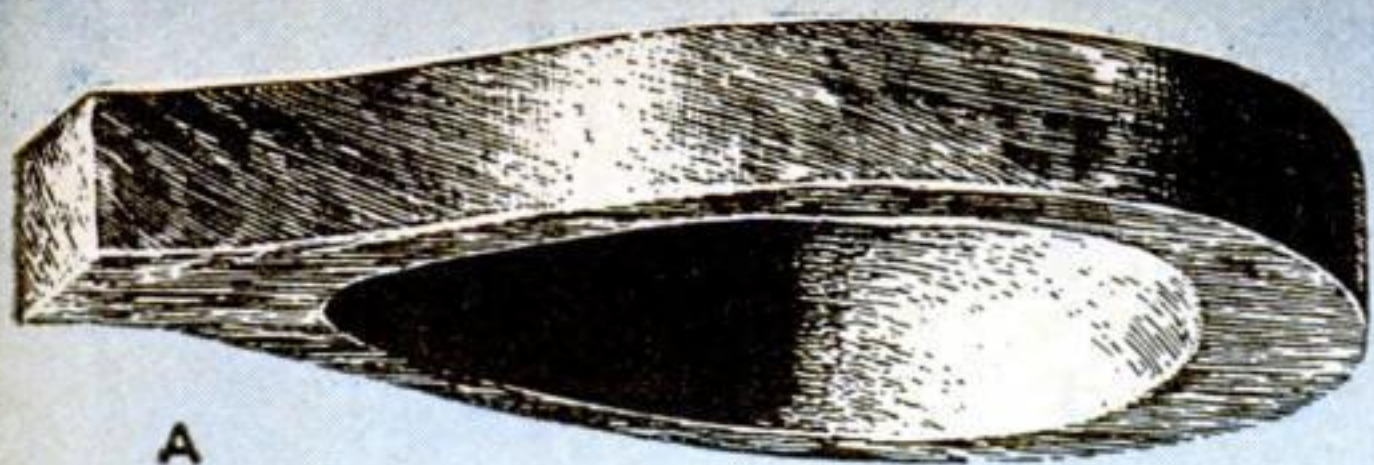
The bodies are of two pieces, each hollowed. So-called 2" plank comes about 1¾" planed, so the decoy body, for economic reasons, is limited to a depth of 3½". The outside dimensions are therefore 3½" by 7½" by 15".

Make two patterns, one for the top half and one for the bottom half, of thin wood or heavy cardboard. These may be sent to a woodworking plant and as many of each band-sawed as there are decoys to be made. Clear white pine is the wood to get, although clear white cedar is even more desirable in localities where it is obtainable.

While the mill is filling the order, make a profile pattern of the head. Mark around this pattern on a piece of white pine 1¾" thick and 3" wide; then saw the block to shape. Smooth the surface where the head is to join the body and draw a 1¾" circle. In finishing, the limits of this circle must be kept intact. A light and very sharp, beveled-edge shingling hatchet is used to chip out the head, and it is finished with a sharp knife and a wood rasp. Upholsterer's tacks, slightly bent together to make them oval, will do for the eyes. Glass eyes are fine for store-window sales, but are of no practical value.

A few feet of ¾" birch dowel stock is smoothed, if necessary, with a wood rasp and sandpaper. The head is gripped in the bench vise and bored about 1¼" deep with a ¾" bit in the center of the base circle. Daub the end of the dowel with waterproof liquid marine glue or other waterproof glue, insert it, and bore a ¼" hole crosswise through the head and the dowel. Drive through this a





A



AA



B



BB

The blanks for the top and bottom of the decoy after being hollowed (A and AA) and completely carved (B and BB). Below, the final assembly

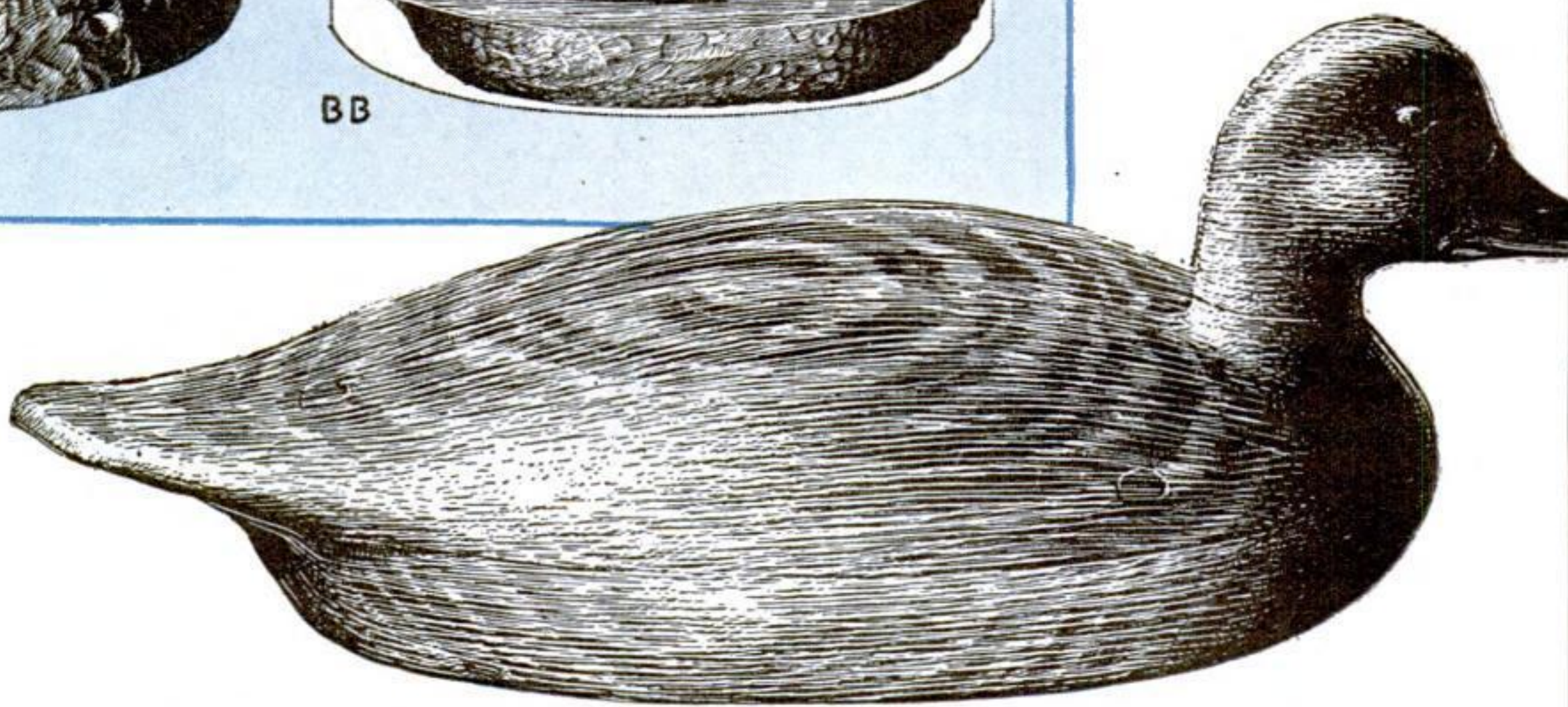
glued $\frac{1}{4}$ " dowel. When the glue has set, the large dowel is cut off $1\frac{5}{8}$ " below the head.

If half-oval brass $\frac{3}{8}$ " wide and $\frac{1}{8}$ " thick can be obtained, buttons for the ends of the dowels can be formed from it; otherwise, hack-saw them from $\frac{1}{8}$ " sheet brass. The buttons are $1\frac{1}{4}$ " long, drilled and countersunk for a thin $\frac{3}{4}$ " brass wood screw. The corners should be smoothed with a file. A notch is then cut in the end of the dowel parallel with the head and just deep enough to sink the brass button in flush. Since the heads are interchangeable, the distance between the base of the head and the top of the button must be just $1\frac{1}{2}$ " in all cases.

The dowel and button must be carefully painted. Successful use of removable-head decoys depends on uniform but not excessive clearances and keeping all movable surfaces painted. If the joining surfaces are not well painted and properly fitted, they will swell up while the decoys are in use.

With the heads made, we are ready to start the body construction. In this it is advisable to carry one process through the entire lot before starting the next.

The hollowing out of the two halves is the first step. A solid V-shaped cleat should be nailed on the bench against which to place the pieces, and a 1" chisel or a gouge and a mallet are the required tools. The gouge does a neater job, but a chisel may prove more effective on certain kinds of wood. A pattern made from the working drawing will aid in marking out the areas to be hollowed (A and AA). Note that in the bottom half an unhollowed area is purposely left so that a recess can be sunk in which



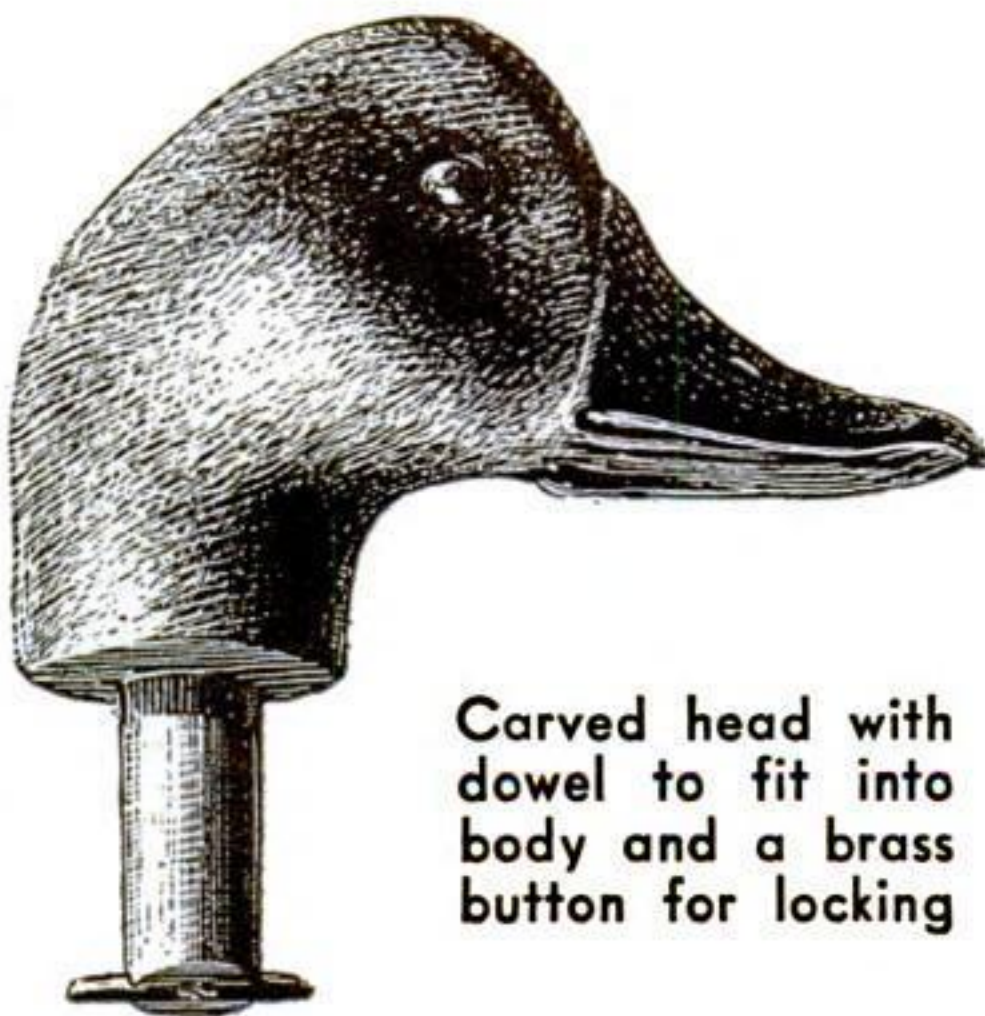
ALL PEN DRAWINGS AND THE PAINTING ON PAGE 159 BY WILLIAM H. FOSTER

the button is to turn. The solid surfaces around this recess must be water-tight.

Now, with the hatchet sharpened to a razor edge, hew all the top halves to the shape shown at B. Here again a $1\frac{3}{4}$ " circle must be marked out on the top surface and left untouched. When the top half has been chopped as nearly to form as it can be, a $\frac{7}{8}$ " hole is bored completely through. Next, with a key-hole saw and a $\frac{1}{4}$ " chisel, cut out the side slots down which the button passes so that the limits of the two slots will be $\frac{1}{2}$ " by $1\frac{1}{2}$ ". After smoothing this passage, paint the interior thoroughly with outside paint. The distance between the base of the head and the top of the button is $1\frac{1}{2}$ ", whereas the hole just cut in the top half is $1\frac{3}{4}$ ", so use a sharp block plane to work the top surface of the neck down until the dowel on one of the standardized heads will go down through the top half freely and, with a quarter turn, fit snugly but not too tight. After this fitting, the top surface of the neck should also be carefully painted.

The same process is gone through with the lower halves (BB), but all the boring needed is a $1\frac{1}{2}$ " hole $\frac{1}{4}$ " deep, in which the button is to project and turn.

Before assembling, the hollowed surfaces should be painted. The joint should be well covered with marine glue, and the halves should be pressed together in the bench vise, but not with too much pressure, because the



Carved head with dowel to fit into body and a brass button for locking

decoy is supposed to be only about $\frac{1}{2}$ " thick on the back. The two halves are fastened together with $1\frac{1}{2}$ " galvanized or brass wood screws, one on each shoulder and one at the base of the tail. Bore $\frac{1}{2}$ " holes for the heads of these screws, $\frac{3}{8}$ " deep, and drill the rest of the way. Over the heads of the screws, set pine plugs in glue. Cross-grained plugs such as boat builders use are much easier to work over than those whittled out with the grain.

When the glue is dry, smooth up the decoys with a spokeshave and wood rasp. Sandpapering is not required. Decoys left rough from the wood rasp will have a more natural texture when properly painted.

Naturally, the decoy maker, after having gone to all the work described, will be tempted to sandpaper the decoys down to a furniture finish. However, there is a good reason for not recommending anything beyond the wood-rasp stage. Wild ducks do not shine, because their oily feathers do not retain water on the surface. The texture of the feathers is dull.

Flat, so-called coach painters' colors ground in japan (not oil) should be used. These colors, which are obtainable in tubes like artist's colors, will dry dull. Avoid linseed oil, which tends to dry with a gloss. Apply the colors in thin paste form. Any thinning that needs to be done should be with pure turpentine.

The color and markings of the ducks that your decoys are made to imitate can best be obtained from mounted specimens, but bear in mind that it is better to undercolor rather than overcolor them. It is the general form that attracts the birds rather than the color.

A brass screw eye placed under the back



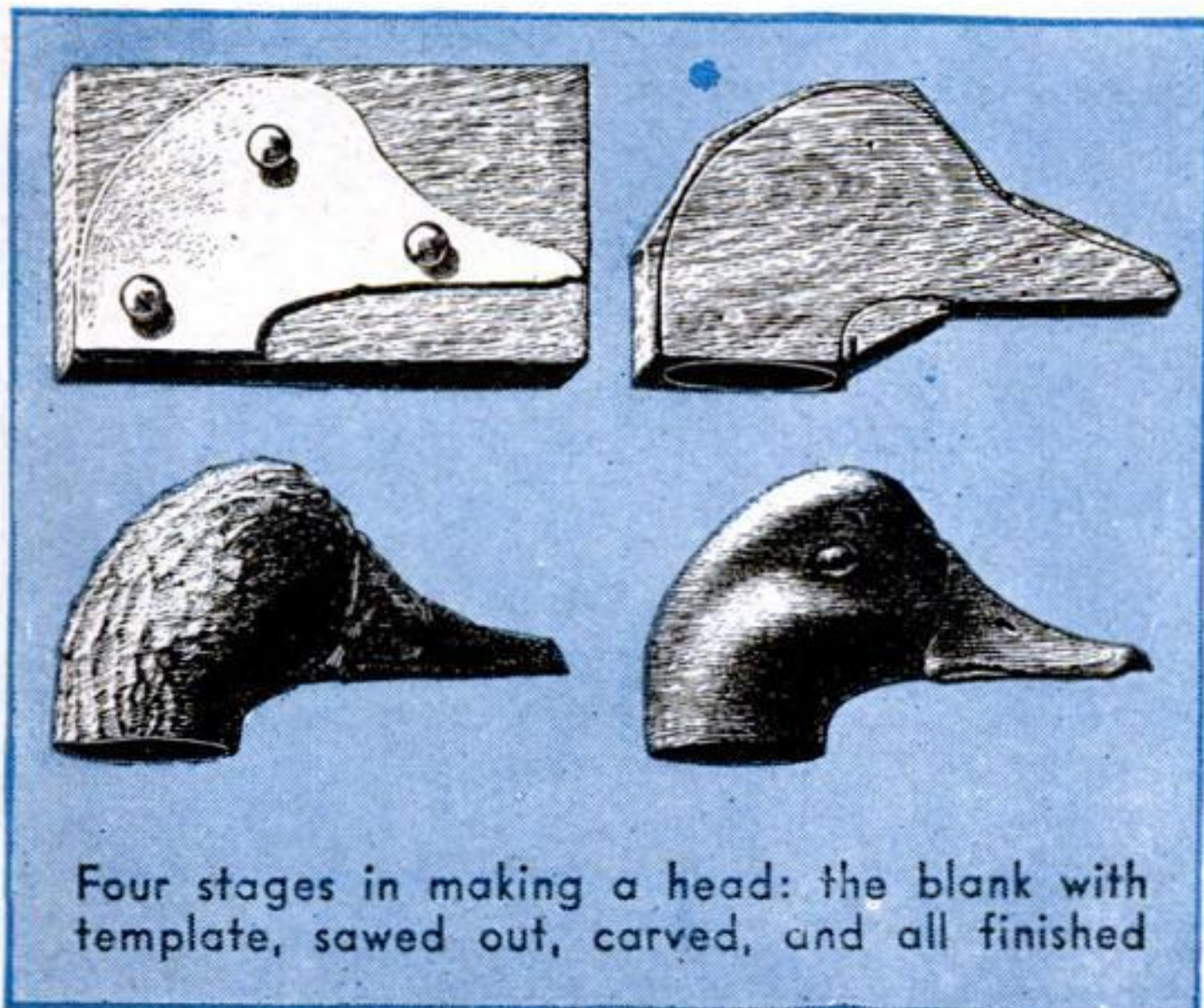
of the neck, but not necessarily in the center, completes the job. The off-center screw eye tends to make the decoy yaw off to the side in a breeze or current and gets it away from the too orderly line of the usual artificial set.

You can, of course, complete one decoy for a pattern and inspiration before starting mass production of the parts, but the work goes much quicker when you complete one process before starting another.

At present the United States Biological Survey, which regulates the national wild-fowl laws, forbids the use of live decoys in duck hunting. Whether this ruling is to be permanent or not, no one knows at this time but even if, at a later date, the ban is lifted, artificial decoys will always be needed to augment the live birds and to increase the display.

Laboratory Thermometer Hung on Cord to Save Breakage

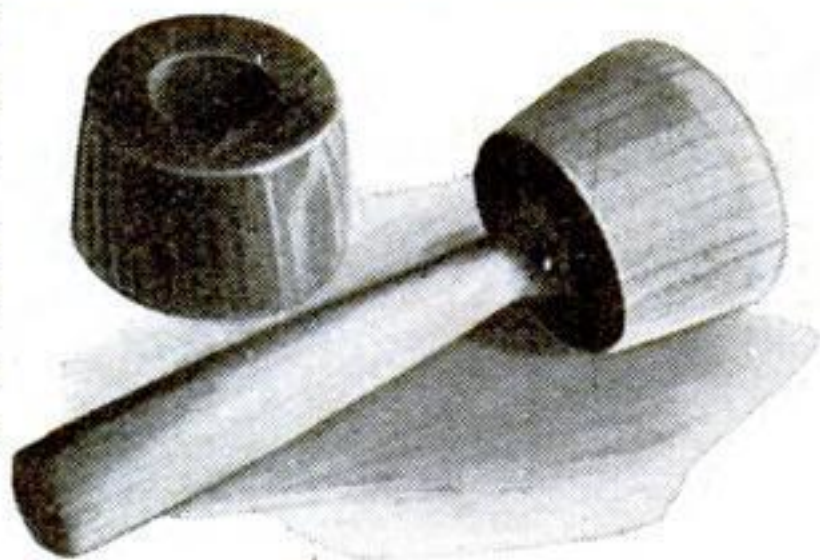
BY SUSPENDING a laboratory thermometer as shown, the danger of breakage can be prevented. A piece of stiff, braided curtain cord is fastened to the thermometer and passed through a screw eye in a shelf over the bench or, if necessary, in the ceiling. When not in use, the thermometer is drawn up out of the way. The cord should fit the screw eye tightly enough so the thermometer will not drop of its own weight. Tie a knot in the loose end of the cord so it cannot be pulled out.—RUSS ALEXANDER.



Four stages in making a head: the blank with template, sawed out, carved, and all finished

Wrapping-Paper Plug Made into a Carving Mallet

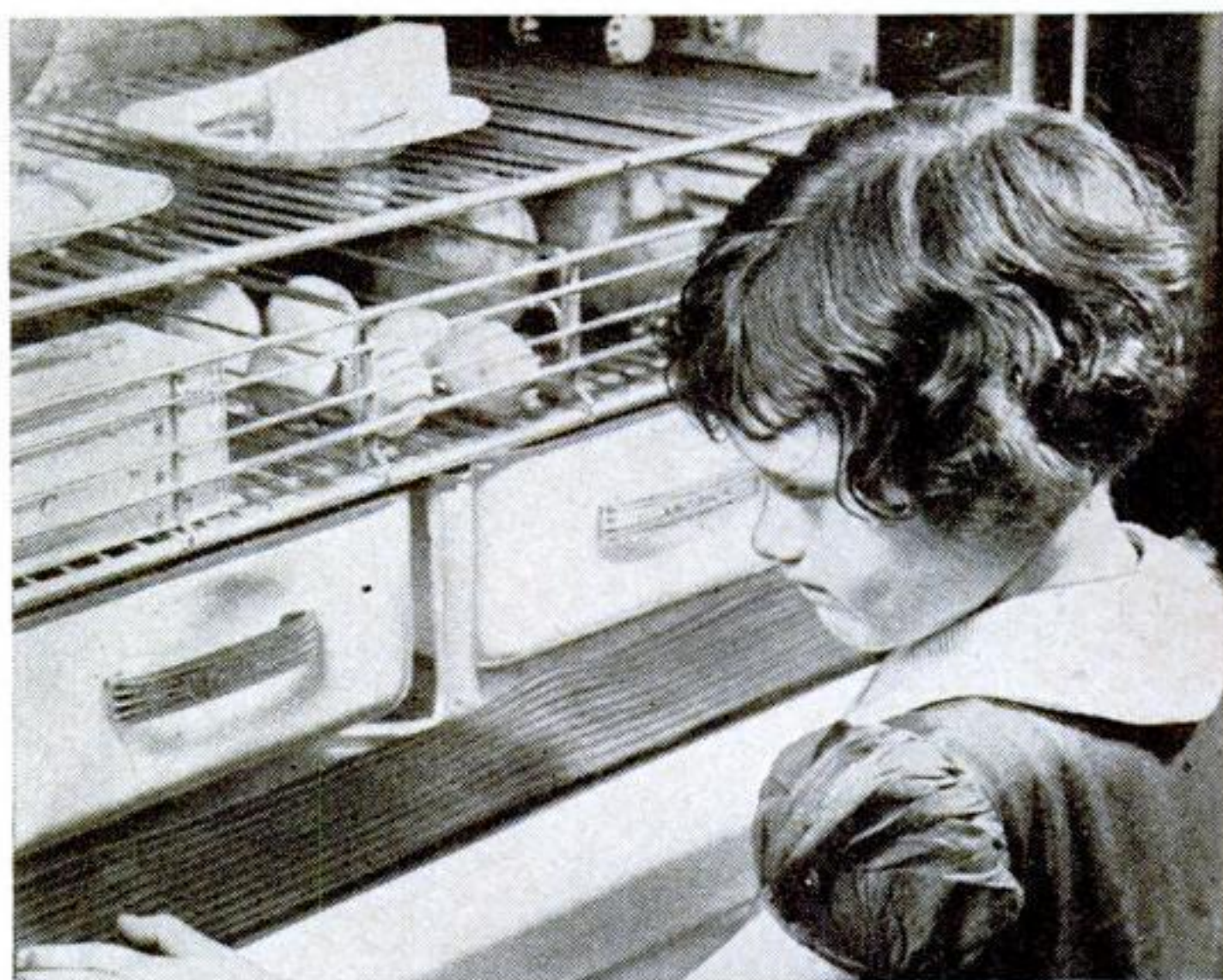
FOR light work with chisel or gouge, the potato-masher type of mallet used by wood carvers is much more convenient than one of the conventional style. A small mallet of this kind can be made without a lathe by whittling a broomstick handle to fit into one of the hardwood plugs found in rolls of wrapping paper. Your grocer probably has an accumulation of these plugs and will be glad to give one to you upon request. The handle for the mallet should be about 9" long.—
JOHN M. AVERY.



Ship's Wheel Converted into a Dining Table

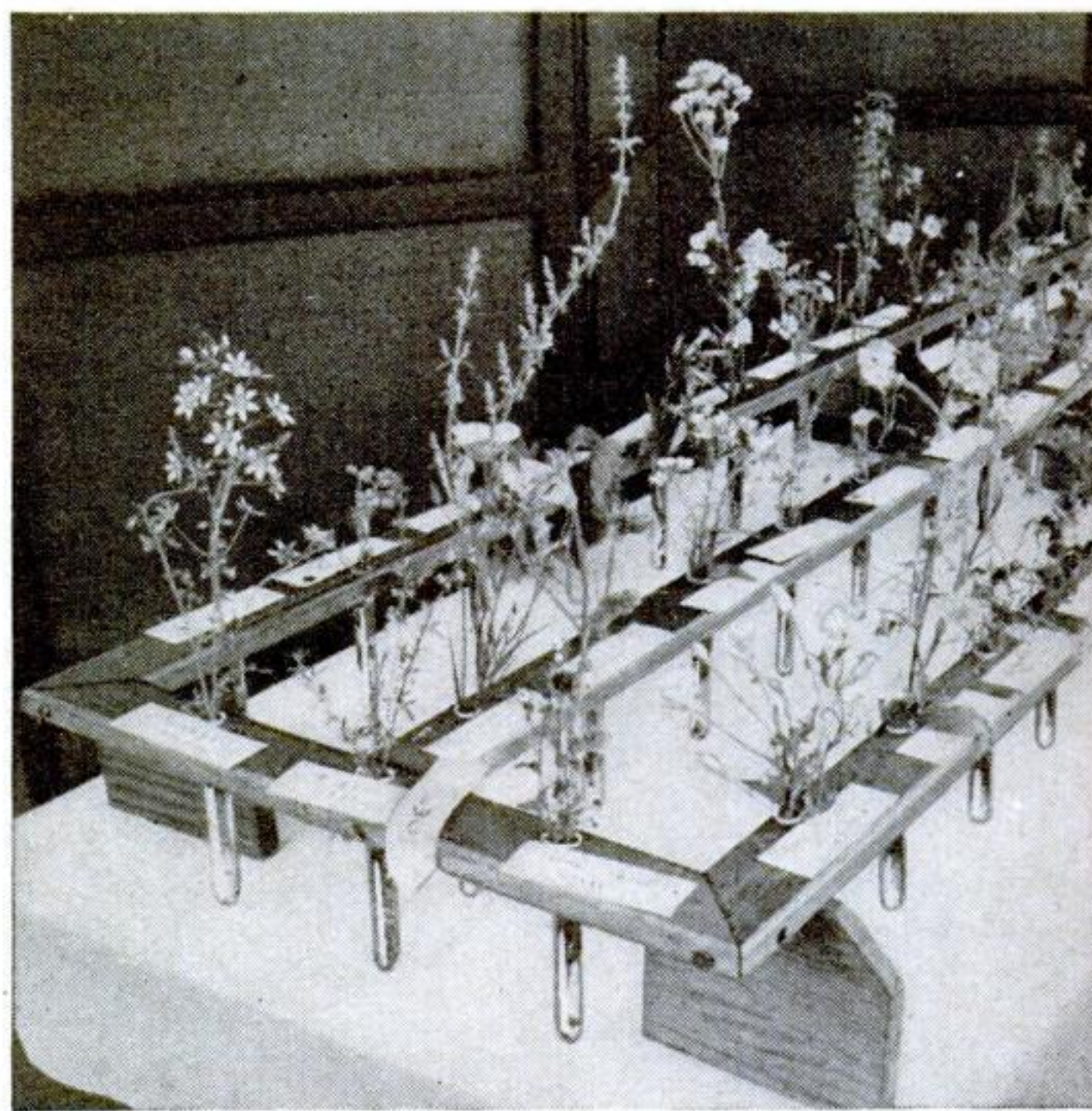
FROM a discarded ship's wheel that had been in service on a four-masted schooner for twenty years, John D. Toft, of Portland, Me., constructed the dining-room table illustrated below. The standards supporting the table are the original ones that held the wheel on the schooner, so everything, with the exception of the plain glass top, is truly nautical.

The wood is mahogany except for the wheel spokes, which are horn-beam. To cover the shaft hole, Mr. Toft had a brass plate made with an inscription telling where the wheel came from, the year the schooner was built, and the name of her present master.



Rubber Matting Protects Refrigerator Ledge

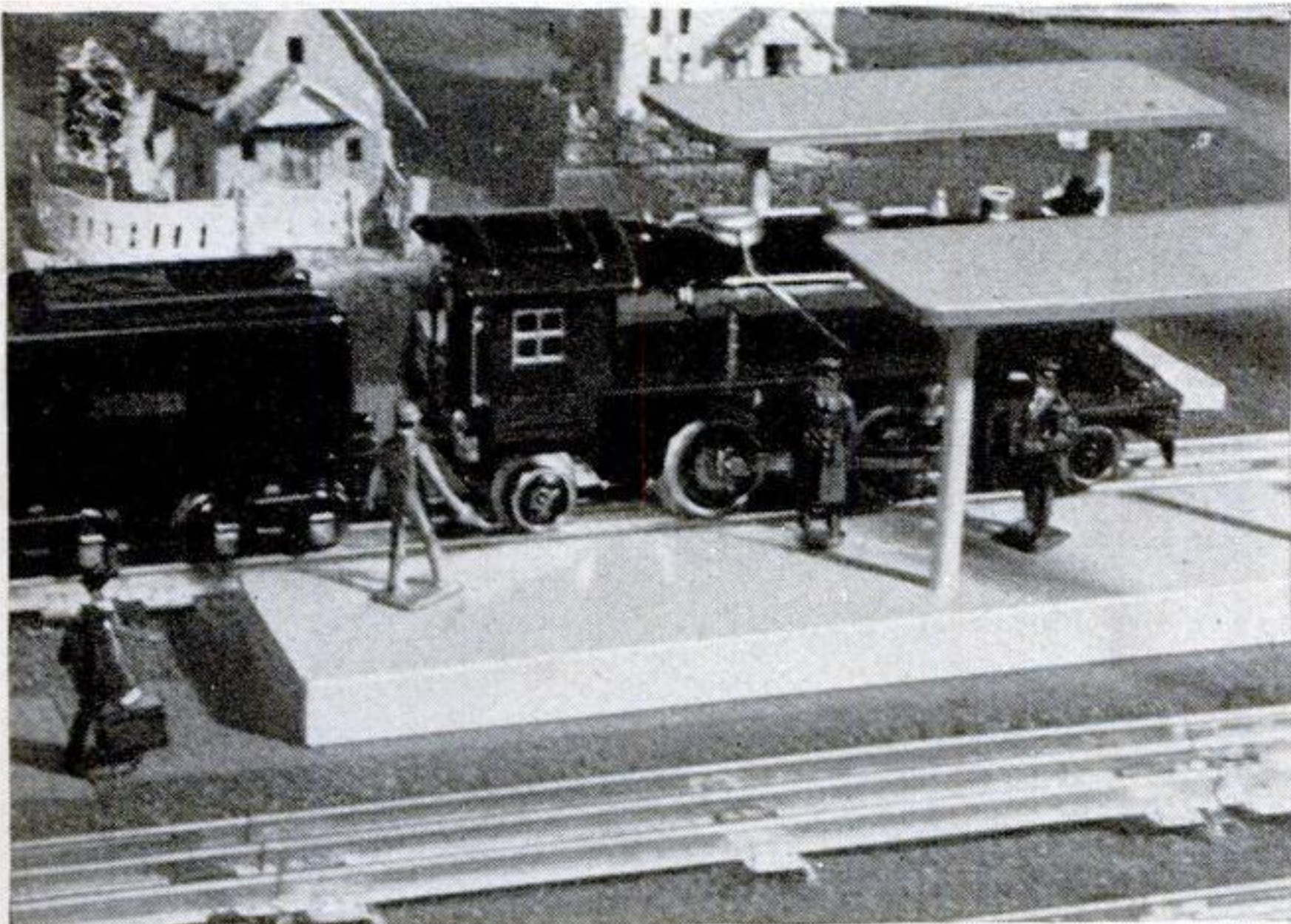
CHIPPING of the ledge underneath the door of a porcelain-coated electric refrigerator can be prevented by applying a strip of rubber mat, or running-board rubber, with rubber cement. The mat makes a neat appearance and, of course, is not visible when the door of the refrigerator is closed.—G.S.G.



Collection of Wild Flowers Exhibited in Test Tubes

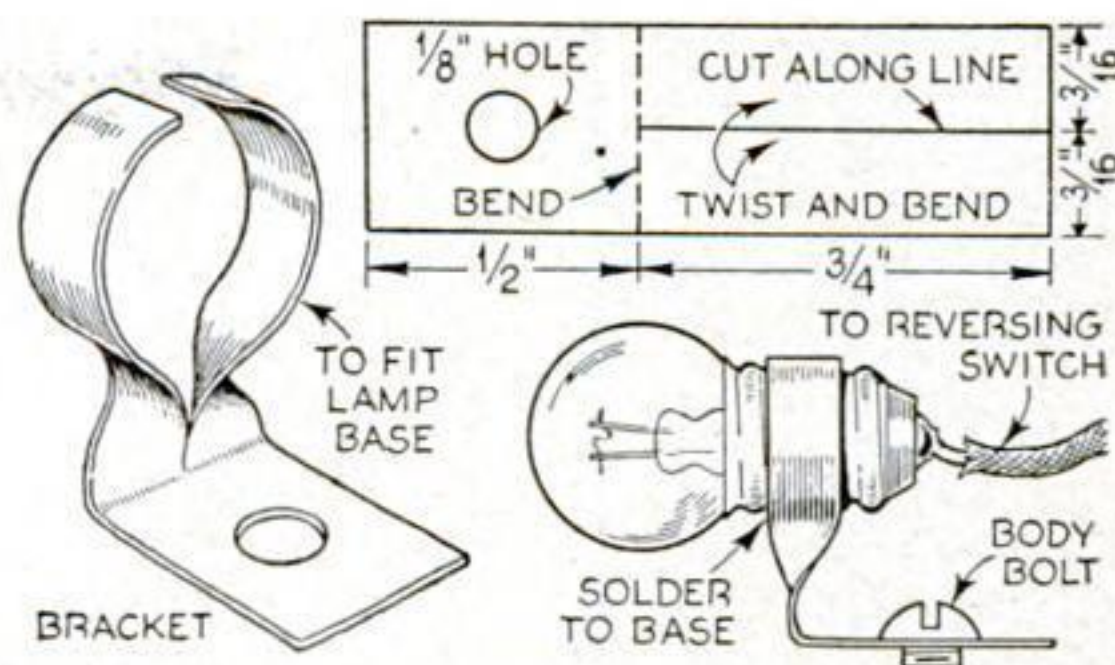
TO DISPLAY a collection of seventy-eight wild flowers, grammar school children at Lakeside, Calif., constructed the rack shown. Holes were bored through the wooden strips to receive test tubes, which were borrowed from the district high school chemistry department. The display won a first prize and a special prize for its individuality at the annual Lakeside flower show.

Red Light Imitates Fire Under Model Locomotive

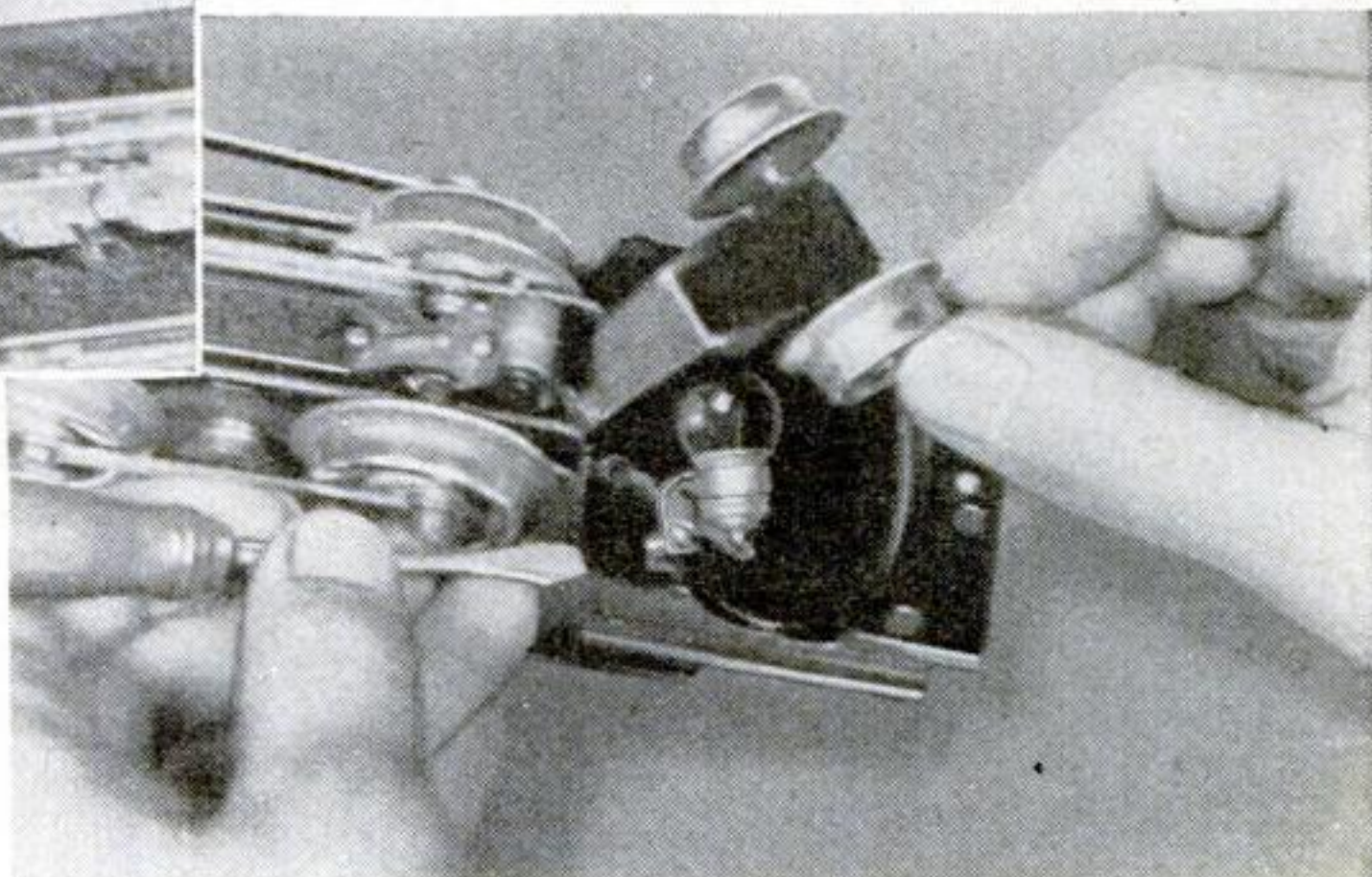


The striking effect of a glowing fire box is given this locomotive by a red lamp placed under the cab

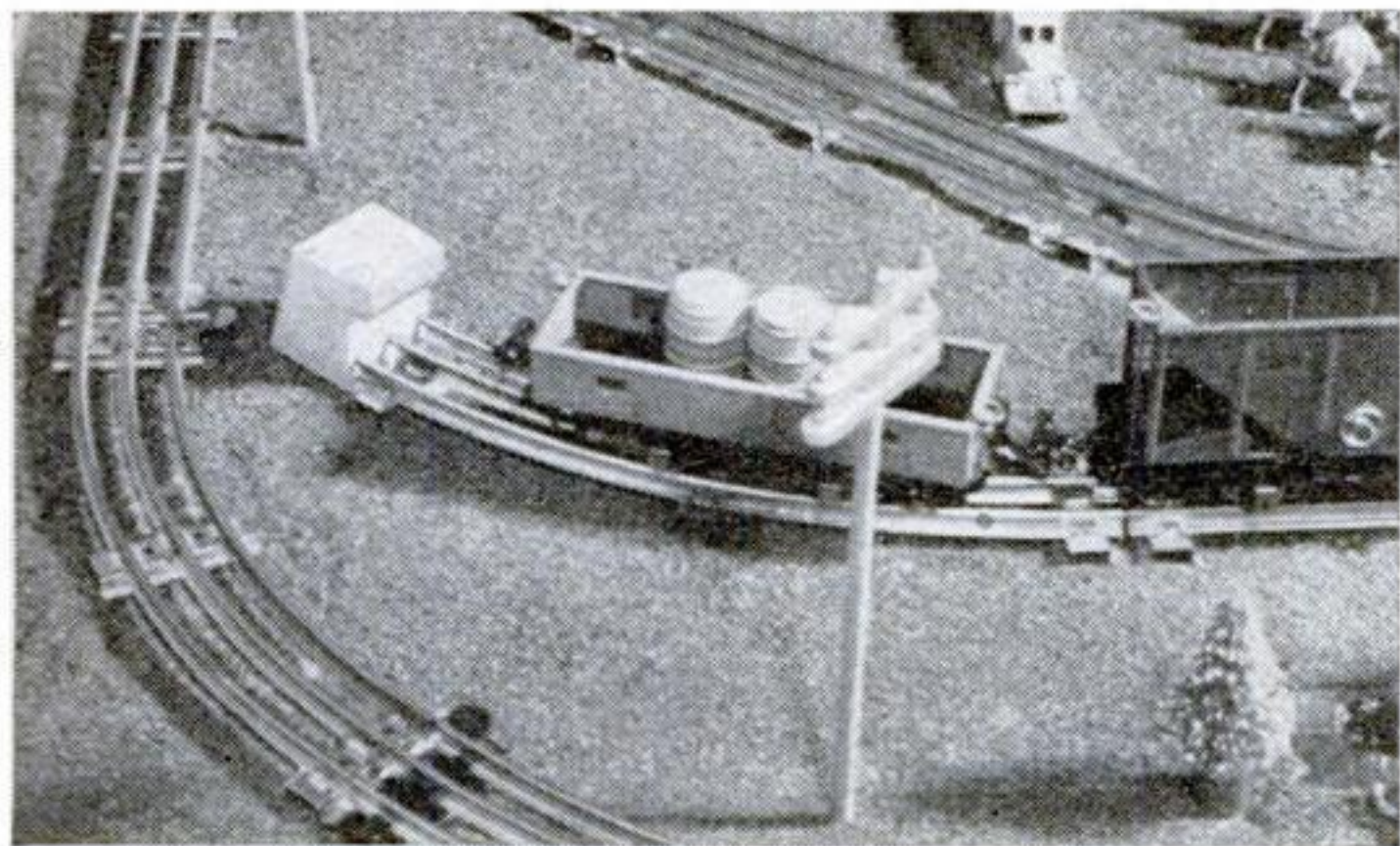
ANY steam-type model locomotive becomes more realistic if a light is added under the cab to simulate a glowing fire box. The socket may be one of those sold eight on a string for Christmas trees, with the composition broken off so the shell is exposed. It is soldered to the bracket. Insulated wire is soldered to the tip of the socket, run through a hole in the locomotive body, and connected to the collector roller or the reversing



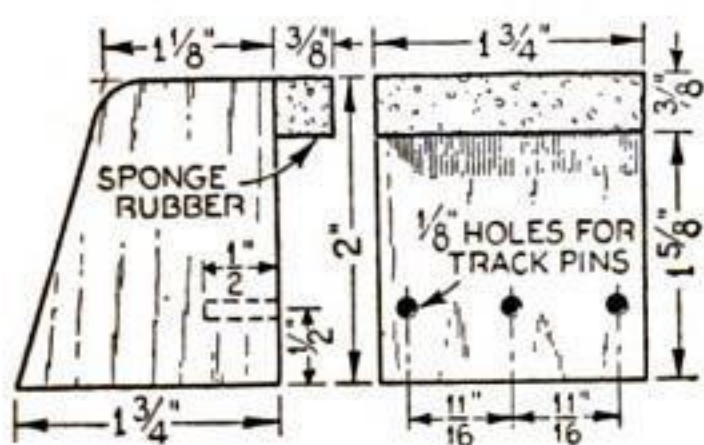
How the bracket is cut out, bent to shape, and installed to hold the lamp



The bracket is held by one of the body bolts. If no red bulb is available, lacquer a plain one red switch. The bracket is placed under one of the body bolts to complete the circuit and hold it securely.—C. ELMER BLACK.



Special Crashproof Bumpers Protect Model Trains



BUMPERS made as shown provide excellent protection for model trains. The sponge rubber prevents scratches, and if the bumper is hit

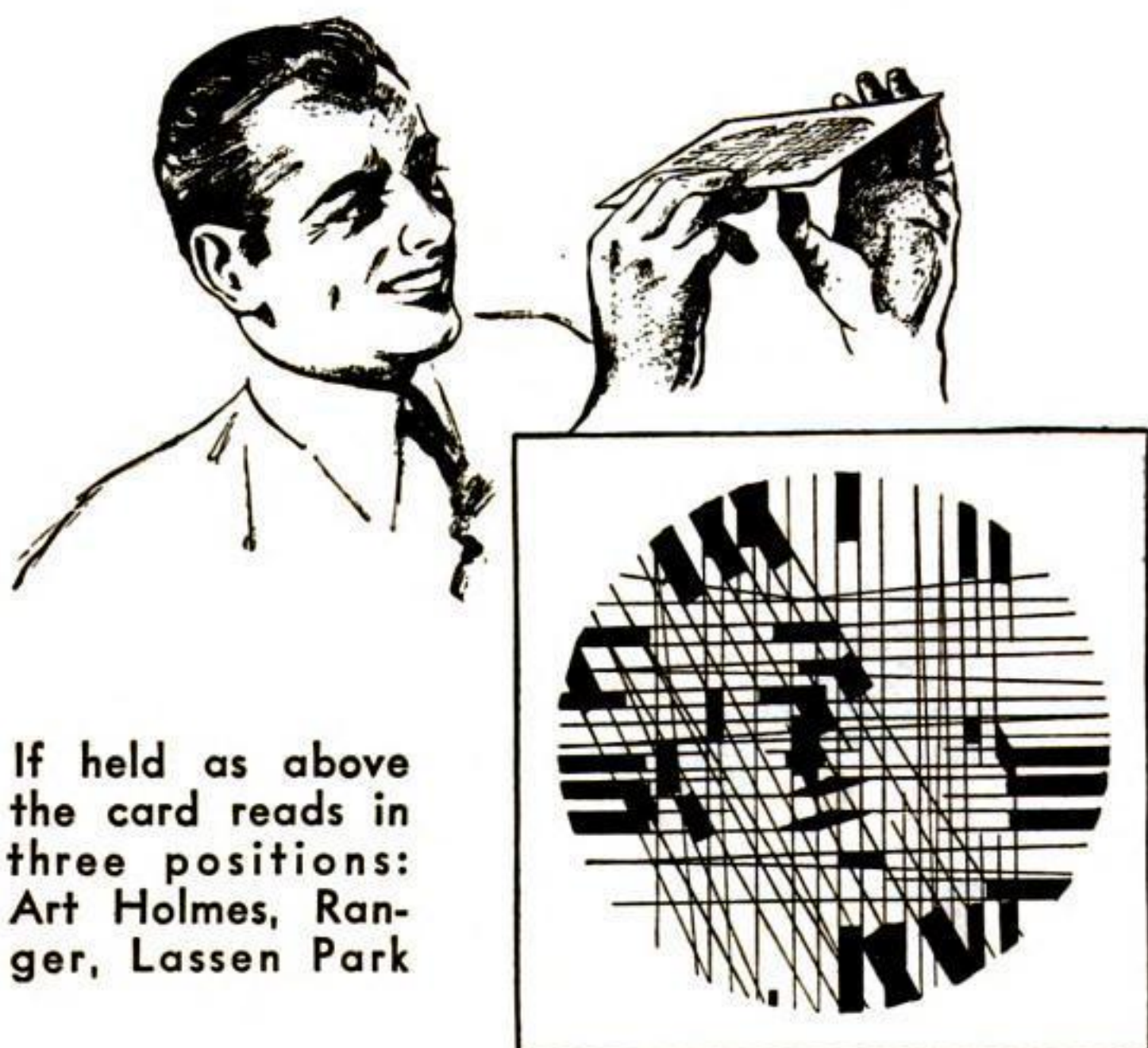
sharply, the block slips right out from the pins to avoid dents or other serious damage to the train. The dimensions, for O-gauge track, may be changed to suit other sizes.

Imitation Coal and Stucco for Model Railway Use

BIRD gravel makes good imitation coal for HO and OO model railway layouts, and a popular breakfast cereal may be used for the larger O gauge. Merely dip the required quantity into a thinned solution of black lacquer and spread on a screen to dry. Ordinary table salt serves for graveled roof tops and stucco if sprinkled on the buildings very lightly while the paint is still wet. In the case of stucco, a finishing coat is then applied over the salt. The effect is more realistic than if sandpaper is used.—C. A. VOELCKEL.

Preventing Third-Rail Squeaks

THE annoying squeak produced by the pick-up shoes of model railway trains can be prevented by greasing the third rail with a mixture of equal parts of petroleum jelly and graphite powder or with commercial graphite grease. Apply only a very thin film. This also reduces the wear on the pick-up shoes and prevents excessive arcing, which tends to burn tiny holes in the shoes.



If held as above the card reads in three positions: Art Holmes, Ranger, Lassen Park

Stretched-out Letters Form Curious Visiting Card

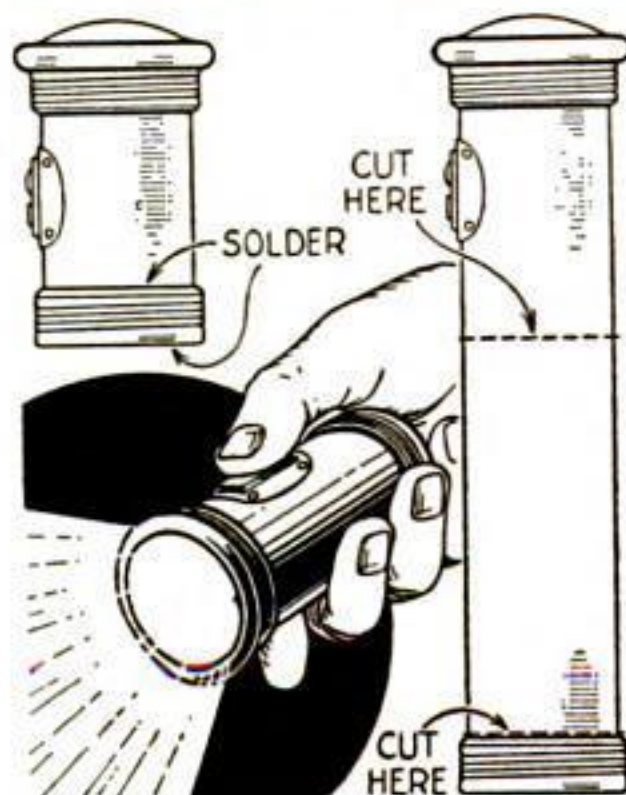
HERE'S a way to letter your name, address, and occupation on a card in such a way as to have a lot of fun with your friends. The example contains the writer's name, address, and title. To read it, hold the page at eye level and sight across the paper, looking along each set of long lines in turn.

Practice your own name on scratch paper to see how the spacing of the letters works out. Once you have learned the trick, you can make a card for yourself by using a ruler and black ink. It is better not to work in a circle less than 3" or 4".

If you wish to make a moderate number of the cards, draw the original large and photograph it on either so-called "process" or "commercial" film to get as much contrast as possible. In printing the finished cards, use a No. 5 (extreme contrast) paper, preferably double weight. For quantities larger than 100, it is cheaper to have the cards printed on a press from a line cut.—ARTHUR HOLMES.

Small Broad-Beam Flash Light

TO PROVIDE a small flash light that would fit my pocket yet give a broad beam, I cut an old three-cell metal case as shown. The threaded portion at the rear was slipped over the forward piece and soldered. The surplus solder was filed off and the case given a coat of aluminum paint. Either a 1.3- or a 1.5-volt bulb may be used. The case of a two-cell flash light may be changed similarly.—JACK C. ALBRECHT.

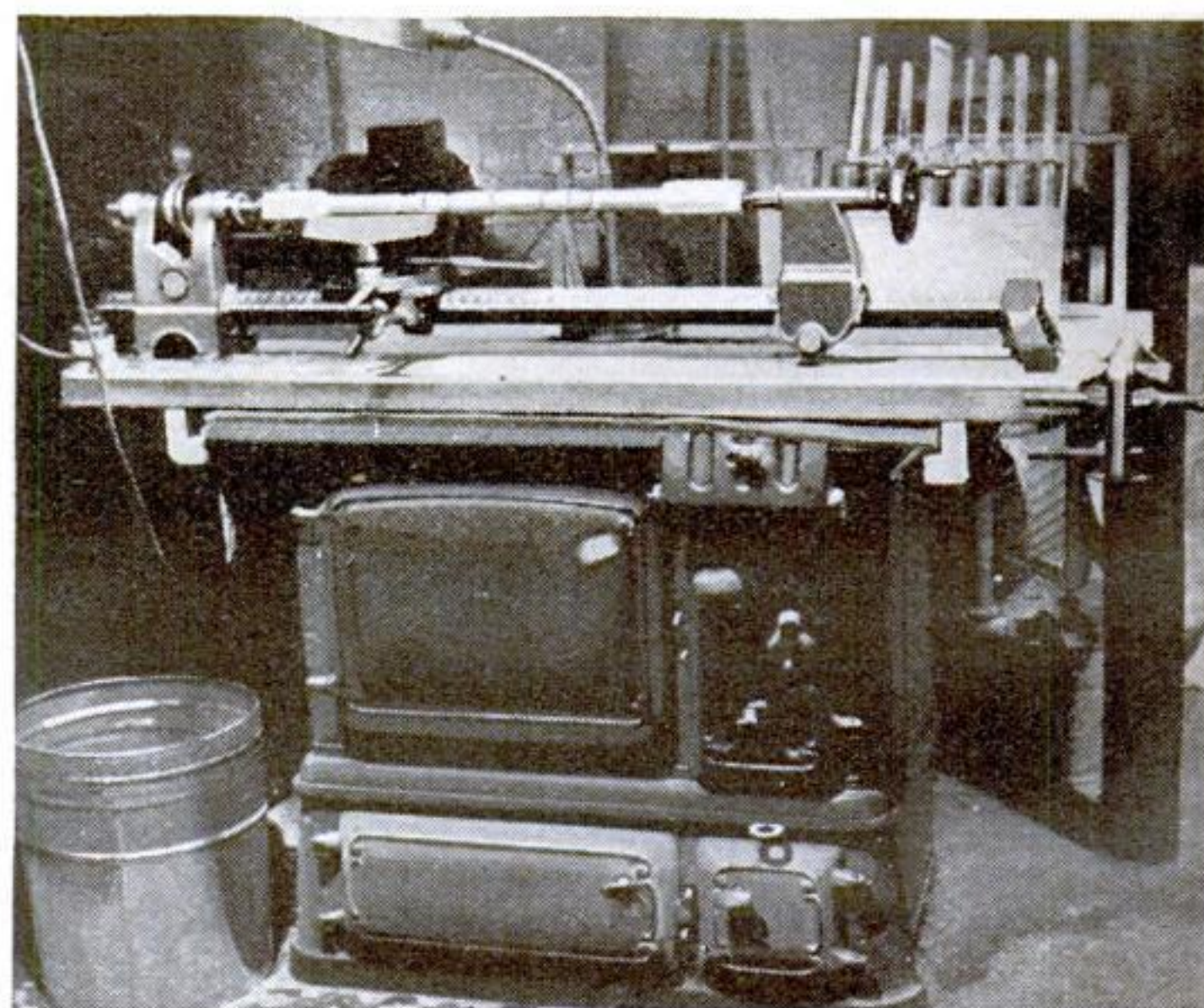


Paper Clips Aid in Making Repairs to Window Shades



IN REHEMMING an old window shade which has been reversed to improve its appearance, wire paper clips may be slipped over the edge every 6" to hold the material flat, as shown.

Before the rehemmed shade is put in use, fasten a pinch-on type of paper clip over each end of the stitching to hold the thread ends and act as a reinforcement. This is also desirable when hanging new shades, as the cheaper makes are sewn with a single-thread lock stitch that is likely to ravel if the free end happens to be pulled.—DON R. FOSLER.



Old Range Holds Bench Lathe


OLD coal-burning ranges, discarded from the kitchen, have been set up for occasional use in many basements. Such a stove will also serve, if necessary, as a vibrationless machine bench. The illustration above shows how a wood-turning lathe was mounted on an old range so it can be readily removed when the stove is used.—DONALD R. DOREMUS.

• Home Care of Furniture

HOW TO CLEAN, RETOUCH, AND POLISH IT

with a sponge dipped in clean, warm water, squeezed out, and then filled with suds from a bar of white, neutral soap. Rinse with clean water and wipe dry. If necessary, sand the entire surface with fine 6/0 finishing paper, moistened slightly on the back with a damp sponge to increase flexibility. Dust off with a brush ready for varnishing, and wipe clean with a tack rag (see page 187).

All this may be done with the furniture in place simply by protecting the carpet or floor with a sheet of strong wrapping or building paper. The same piece may be used for all the furniture in the room that needs touching up. When each is



TOUCHING UP the foot of a chair that has been marred by frequent contact with a vacuum cleaner. High-grade semigloss varnish is used

By RALPH G. WARING

GOOD furniture, if properly cared for, will give a lifetime of use. The best of housekeeping, however, will not prevent occasional scratches or other damage from vacuum machines, inadvertent heels, or bumps caused by moving furniture around. Every one should therefore know the best methods of removing blemishes and keeping furniture well polished.

Modern finishes are of such high quality that it is seldom necessary to refinish a piece entirely unless it has developed loose joints or met with some serious accident. And loose joints can be avoided by keeping the humidity at the proper level, especially in the winter. If rooms are kept at 72 deg. F. for the dry-bulb reading, the wet bulb of a hygrometer should show a difference of 10 or 12 deg. to give a relative humidity of 57 deg., which is nearly ideal both for human beings and their furnishings.

Marred table legs, chair feet, and pedestals. Clean well by washing the area



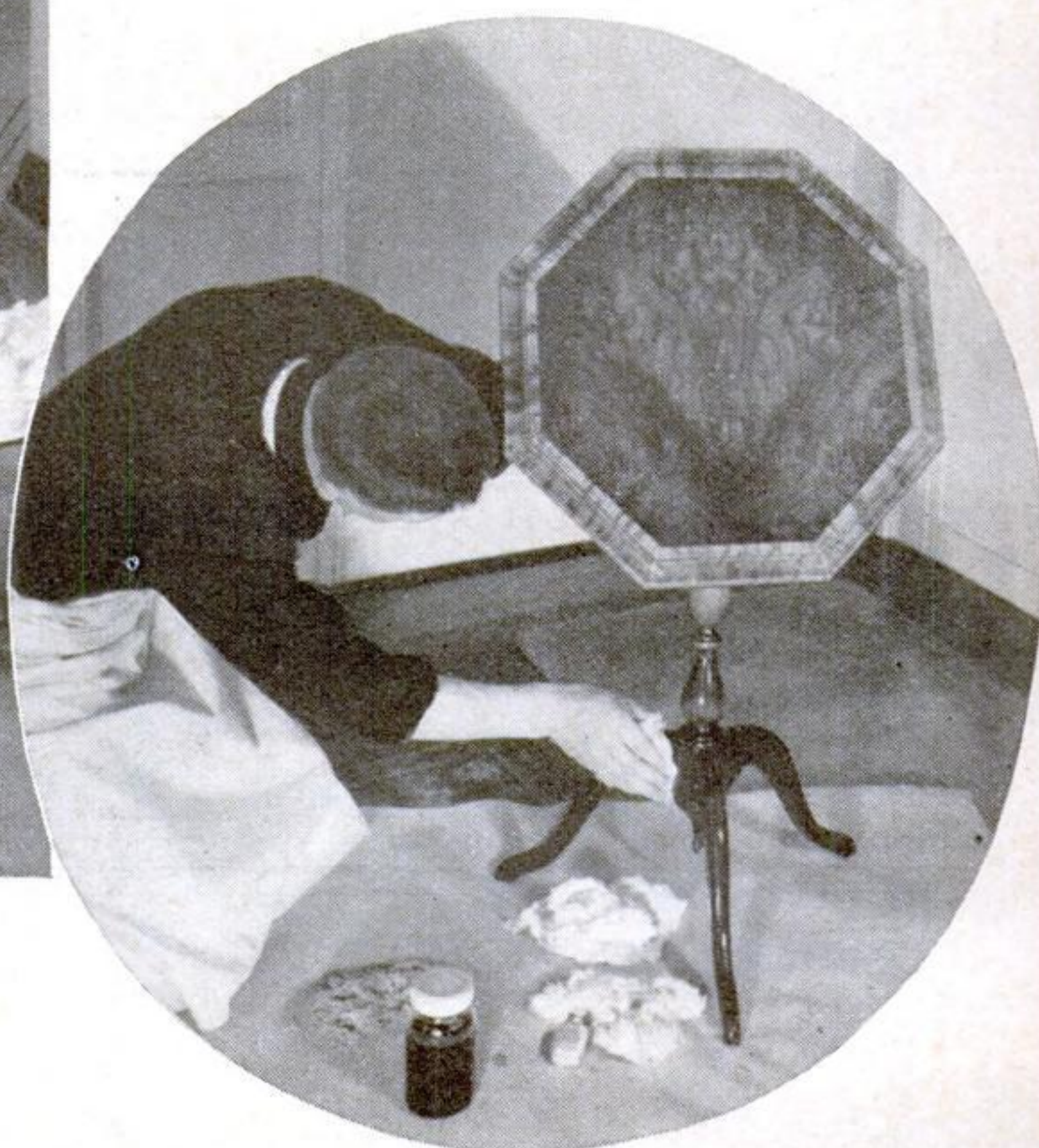
Ralph G. Waring scoring the design, finish, and sales appeal of new furniture. He is a research chemist and specification engineer on paints, oils, varnishes, and stains, and a regular contributor to this magazine



CLEANING a piano with neutral white soap suds on a sponge preparatory to polishing. Right, applying polish to a tilt-top table after it has been washed in a similar way

completed, replace the large sheet of paper with a small paper square under each foot or leg.

The varnish for retouching need not be a gloss varnish unless several coats, followed by a complete rubbing, are to be given. Usually one coat is sufficient, therefore a flattening varnish of the eggshell or semigloss type or else a dull or dead-flat varnish is used. The latter is too dull to imitate a good oil-rubbed surface, but it may be changed to a semigloss varnish by mixing one part of the dull varnish in one or two parts of gloss varnish. If that is done, take particular care that both var-



FURNITURE POLISH

[PAINTING]

12 oz. paraffin oil (light golden rubbing)
2 oz. turpentine
4 oz. raw linseed oil

10 oz. denatured alcohol
16 oz. soap solution (15 oz. water, 1 oz. white soap)
1 oz. butter of antimony solution

Mix in order given, up to and including the alcohol, with a rotary egg beater in an enamel or glass jar. Add soap solution gradually while beating, and finally run in the butter of antimony slowly. These should make a creamy mixture. If separation occurs later, shake well before use. Apply freely over entire piece with pad of soft, clean cloths squeezed out in tepid water. Follow with a dry cloth and wipe free of all traces of polish, which is most important. For carvings and moldings, apply with a brush and wipe dry. Make certain that all corners and joinings are wiped clean.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

STAIN for FURNITURE SCRATCHES

[PAINTING]

1 oz. oil-soluble walnut or mahogany stain powder ½ pt. orange shellac

1 qt. lacquer thinner

½ pt. shellac mixing lacquer or wood lacquer

Dissolve stain in lacquer thinner. Blend shellac and mixing lacquer and add to first mixture. Apply with a very small artist's brush, called a "pencil." (This mixture also can be used in the spray gun as a shade coat, but strain and thin further if necessary.) Any shade of red and brown can be made by adding carefully the necessary mixtures of red, yellow, orange, or black stain powders.

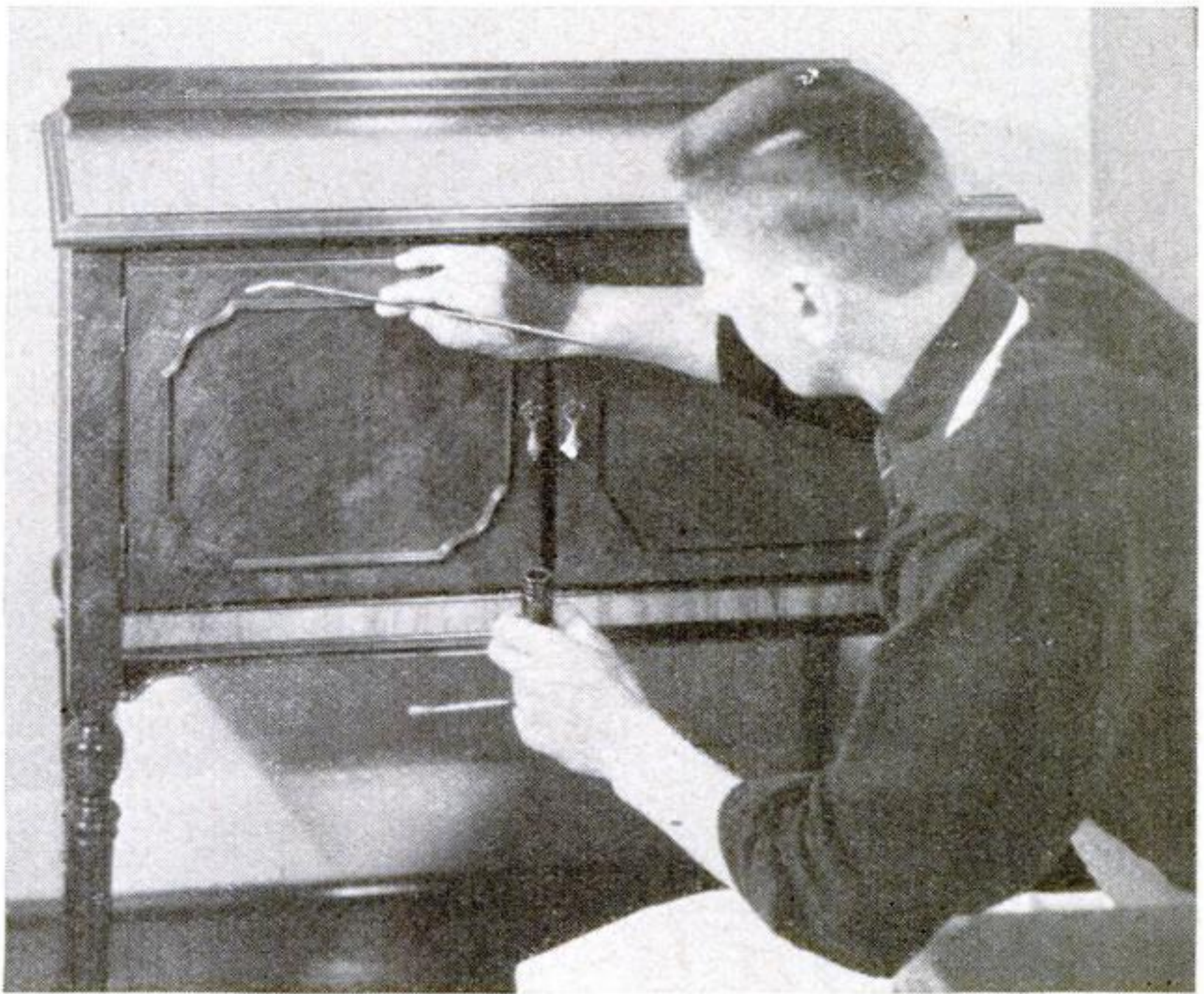
POPULAR SCIENCE MONTHLY SHOP DATA FILE

nishes are from the same company and of the same type—four-hour floor varnish, for example.

Scratches. If there are scratches in the form of fine, white lines, they must be shaded out or run in with a very small artist's brush, called a "pencil," before the retouching varnish is applied. The stain for this purpose is given above.

Cleaning and polishing. All furniture should be cleaned two or three times a year. For this there is nothing better than a soft sponge and suds if followed by a clean water rinse and dry wiping.

To restore the luster or normal gloss to the freshly cleaned surfaces, whether shellac, lacquer, or varnish, some form of polish is necessary. It is best either to purchase a polish from a high-grade piano or furniture firm or mix your own according to the formula given on the facing page. That formula has stood the test of years and can be relied upon as being safe to use. If a polish is purchased, it should be almost odorless, it should clean and brighten the surface, and most important of



CONCEALING a scratch with a so-called "lacquer stain" applied with a hair-line brush. The stain formula is given above

all, it should leave the surface free from all traces of oiliness or grease. Under no circumstances use a cheap polish.

Next month Mr. Waring will discuss floors and their care.

Dabs of Paint Help Identify and Replace Blown Fuses

SOMETIMES finding a blown-out fuse requires considerable time, especially if there are many fuses in the fuse box. This can be avoided by marking the socket base of each set of fuses with a stripe or dab of paint—a different color for each set. On the cover of the fuse box, or in some convenient

place, make a corresponding colored mark and indicate the group of lights the set of fuses controls, such as kitchen and living-room or hall and porch lights. In this way, knowing the group in which the lights do not burn, the useless fuse can quickly be traced and another inserted.—P. F. ROSSMANN.

TRY THIS VERY EASY WAY TO

Whittle a Horse

By
CARL G. ERICH



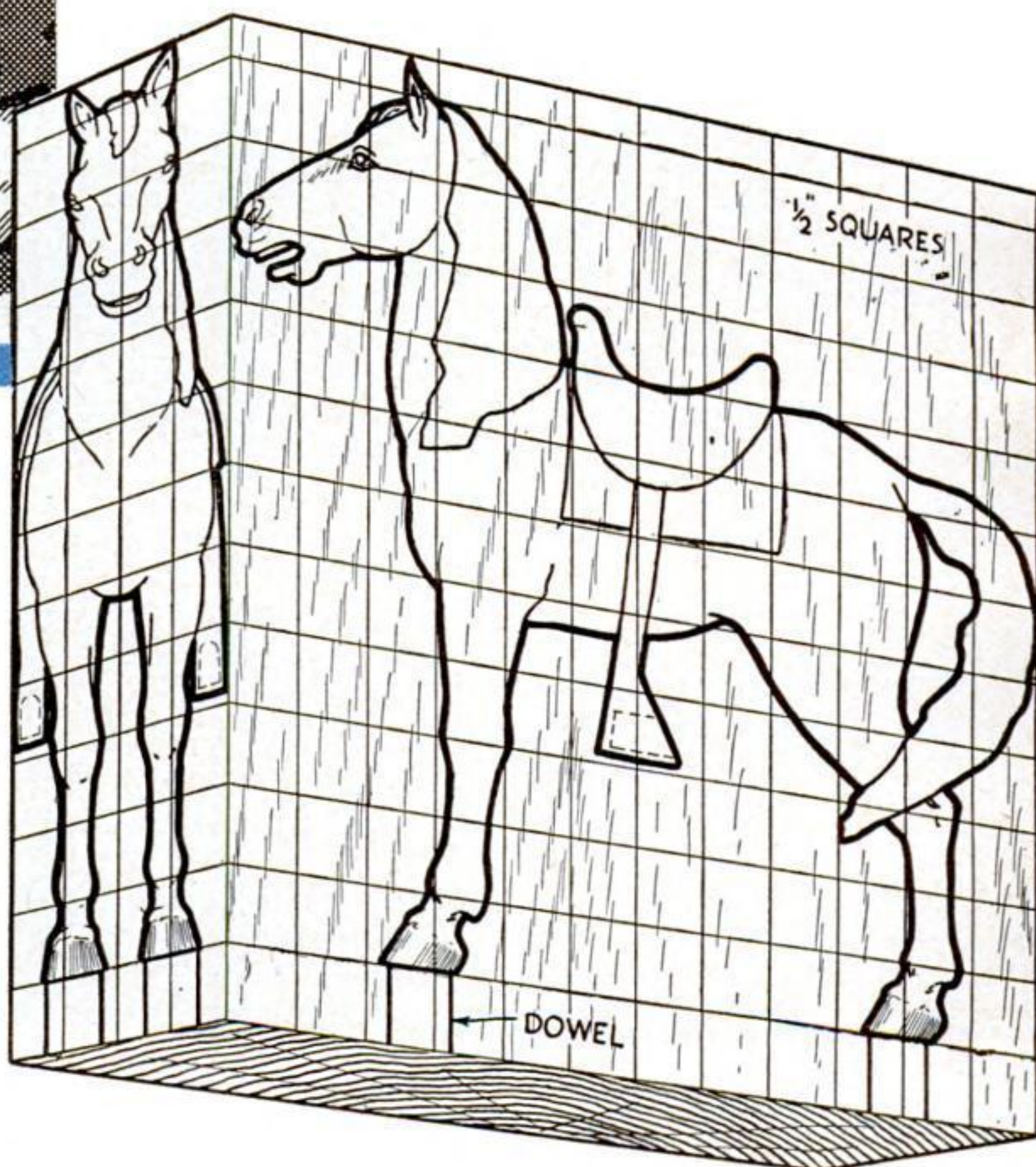
sawed edge, and for your first attempt, keep the horse's head straight, although I usually turn it slightly to one side. Cut between the ears, then on the outside of them down along the jawbone. Leave plenty of stock on one side for the wind-blown mane, with a few V-cuts at various points of the mane. The

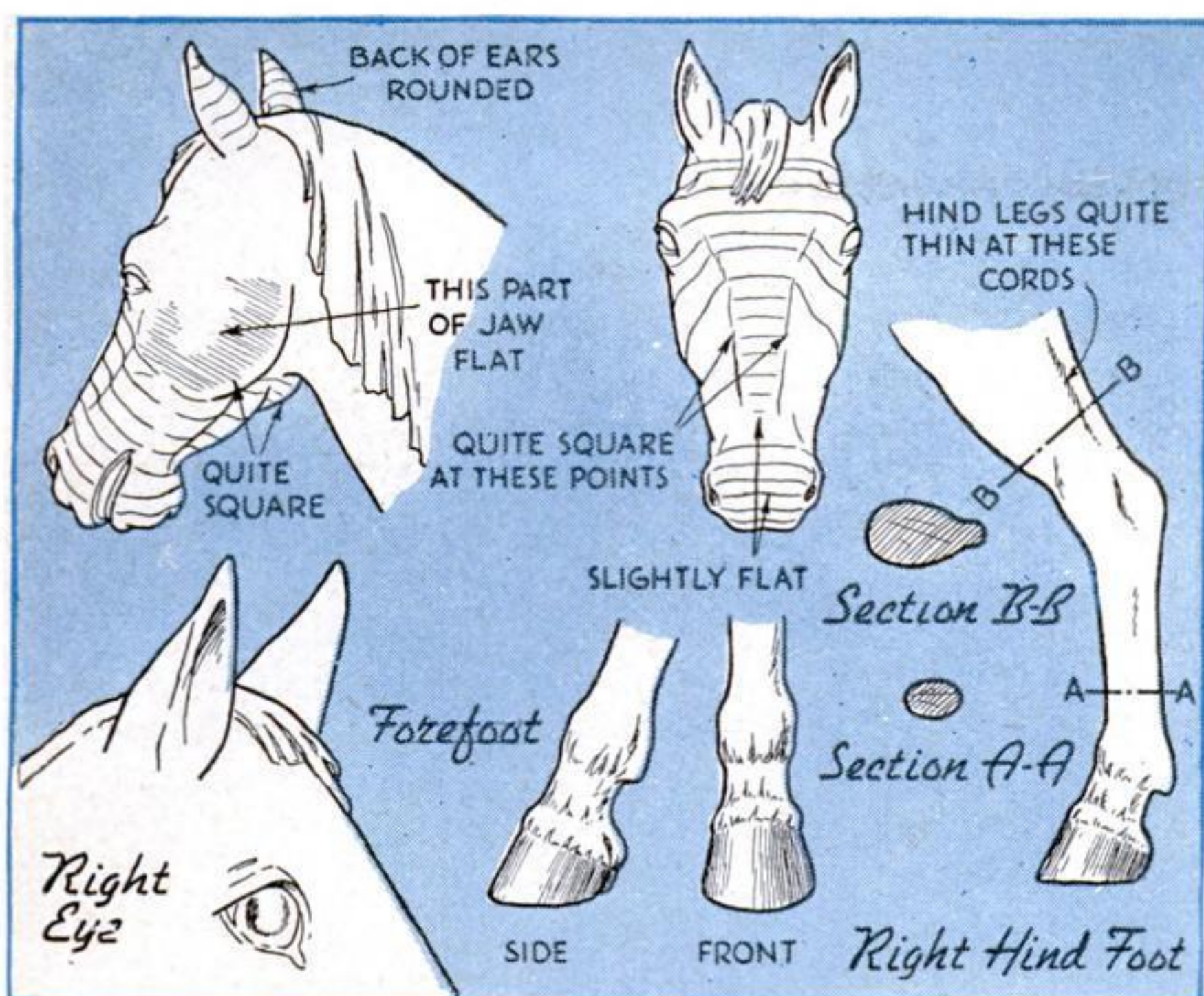
After the block has been sawed roughly to shape, a center line is marked all around

IF YOU have never tried to whittle a horse, you will be much surprised at what a good job you can make by following the method illustrated. You must, however, keep a sharp edge on your knife at all times.

Use a soft white pine block 2" thick, 6" wide, and 6½" long, with the grain vertical. Mark the side view on the wood, or draw it first on paper, then transfer it with carbon paper. Cut the outline with a jig or band saw, if available.

Draw a center line all around the





Sketches to aid in carving the head, eyes, ears, legs, and feet

jawbone is quite square underneath. From the edges down toward the nostrils the shape also is somewhat square.

Although whittling the saddle is not at all difficult, you may omit this on your first model if you wish. Remember that the belly is about the thickest part, so do not cut away too much. Round off the edges of the back and belly more or less egg-shaped. Let the tail have a wave so as to come on the outside of one of the hind legs, and leave it connected to the leg.

Cut away between the front and hind legs.

Do not whittle continuously at one part, but keep turning the block. For instance, cut at the head for a time, then work on a front or a hind leg. Keep in mind the whittler's maxim: Always look twice before you cut. I always use clippings for reference, so hunt through magazines and newspapers for pictures of horses.

You may leave the knife cuts as they are, or smooth them with sandpaper. Many expert whittlers avoid sanding and dislike a too smooth effect.

Leave a dowel at the bottom of each foot, place the horse on a base $1\frac{1}{2}$ " by 3" by 6", mark for the dowel holes, and bore them. The bridle may be made from a very thin piece of scrap leather. Cut strips $\frac{1}{8}$ " wide by using a steel straightedge and a sharp knife. The leather on each side of the saddle is $\frac{1}{4}$ " wide

and slit three times. Fasten the bridle and saddle leather with short pins, but not until after painting the horse, if you wish to do so.

I have found common inside house paint thinned with an equal amount of turpentine is a satisfactory finish, without gloss.

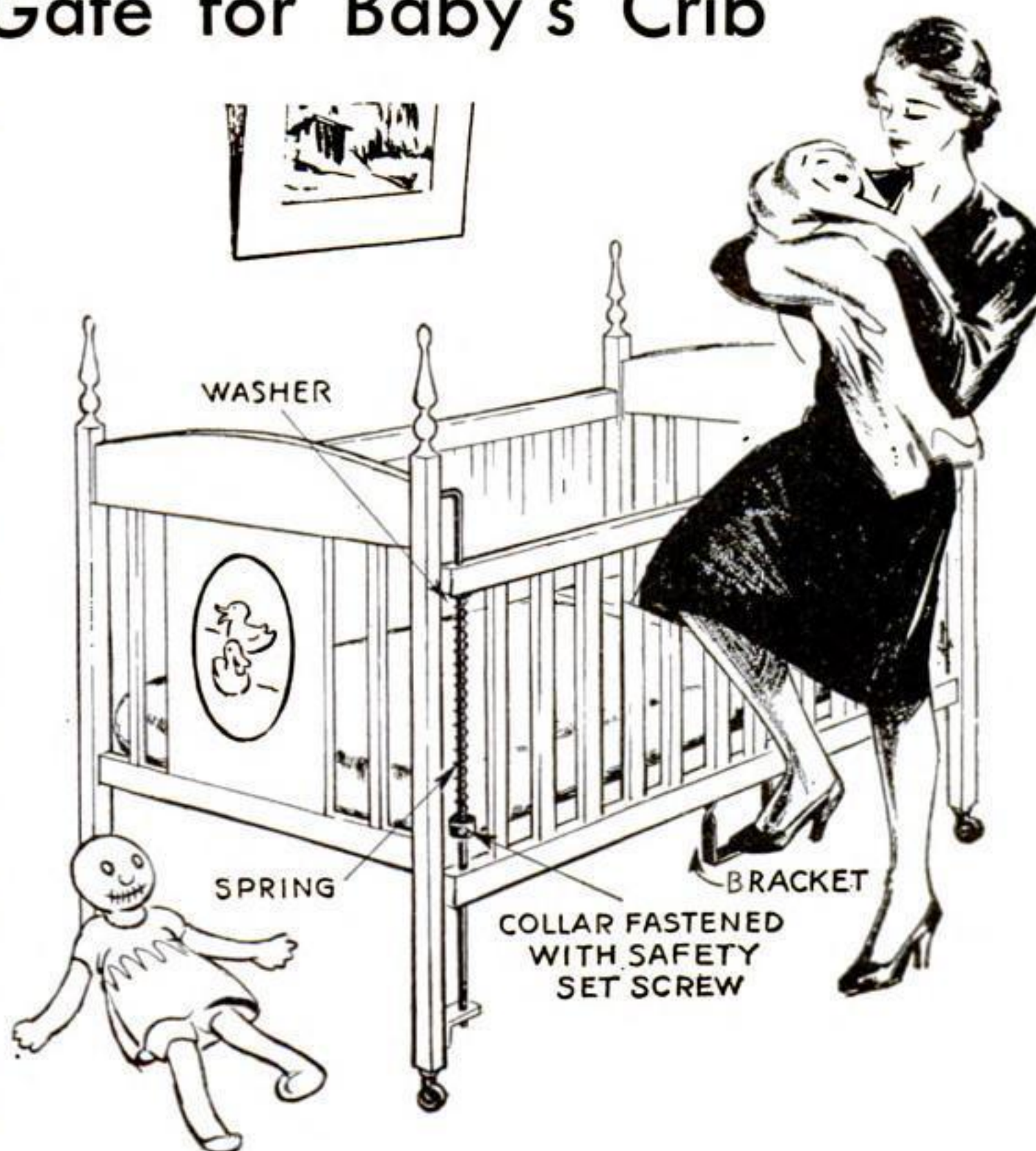
Egg Whites Make Fine Mucilage

WHEN an especially fine quality mucilage is required, try fresh egg white. It will hold securely and will not stain paper or cardboard.—EDWARD VAUGHAN.

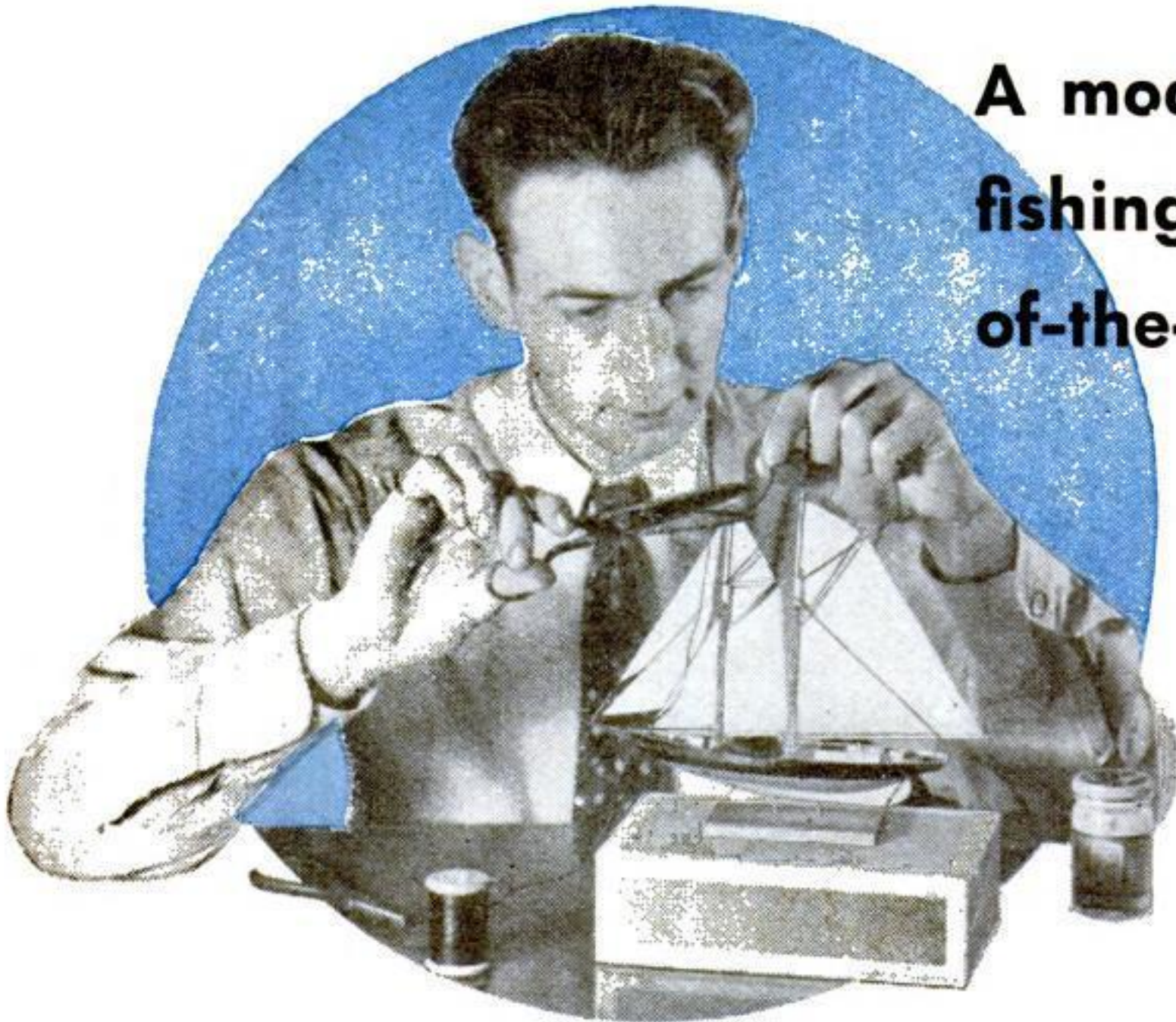
Spring-Operated Safety Gate for Baby's Crib

MANY baby's cribs have one side which can be lowered like a sliding gate, and care therefore has to be taken that it is properly locked in place otherwise it may drop by itself and possibly allow the baby to fall out. It is also somewhat awkward for a mother to operate the gate without using both hands. These drawbacks may be overcome by the method illustrated. Two springs hold the gate in the raised position, but it can be lowered when necessary simply by pushing it down with one foot. When the foot is removed, it automatically springs back in place. Because of this, do not use springs that are too stiff, or the gate will go up with a bang.

The required parts are two springs 20" long and about $\frac{3}{8}$ " in inside diameter, two $\frac{3}{8}$ " washers, two collars with $\frac{3}{8}$ " holes or of a size to fit the rods on the crib, one foot bracket bent to the shape shown from $\frac{1}{2}$ " by $\frac{1}{8}$ " flat iron, two No. 10-32 screws with nuts and washers, and two $\frac{1}{4}$ " safety set screws $\frac{1}{8}$ " long.—PETER MIEDEMA.



The WE'RE HERE



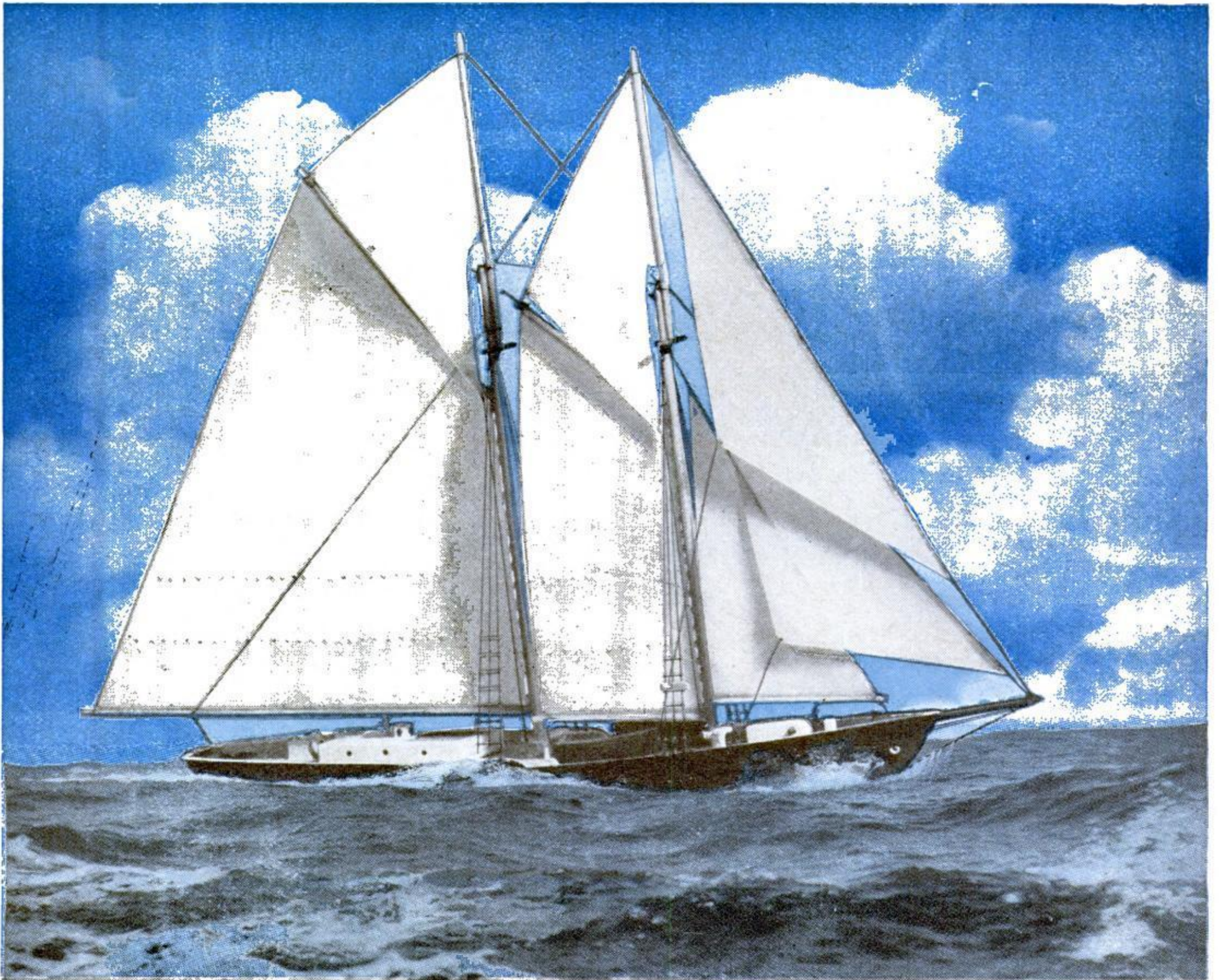
A model of the "Captains Courageous" fishing schooner designed for our Model-of-the-Month Club by Donald W. Clark

EVERY ONE who has read Kipling's *Captains Courageous* or has seen the thrilling movie of the same name has an unforgettable memory of the fishing schooner *We're Here*. What a subject for a ship model!

The accompanying illustrations show how to make a simplified model of the *We're Here* as used in the movie. It has an overall length of 9½" and is built on a scale of approximately 1" to 19' of the real schooner.

How realistic this little model is, may be judged from the view below, where it is shown against a projected background of clouds, with waves from an actual photo used in the movie "Captains Courageous"

Mark the hull block as shown, cut out the side profile or sheer, and true up the deck surfaces. Drill holes for the masts and fife rails, and take care that the mast holes slant



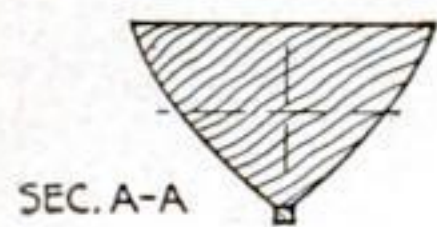
in Miniature

back a trifle. Next, saw out the curve of the hull as required by the deck plan. Carve away the excess wood with a sharp knife, being cautious to preserve the keel portion. If you roll the hull under a light and watch the curves, it is easy to check the contour without bothering to use templates. Smooth the wood with medium, followed by fine, sandpaper. Glue on the keel and fit the rudder.

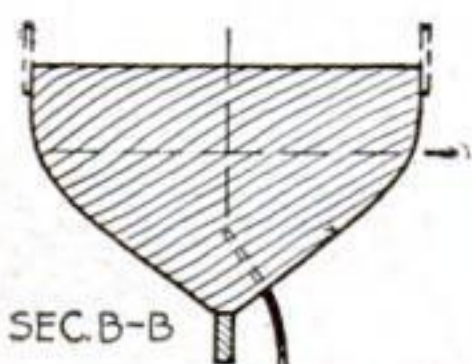
It is a good idea to mount the hull, when shaped, on a base with two bent wires, as shown, so that it will be held firmly while the other parts are at-



So simplified is the model that only forty-six pieces are needed, including seven sails



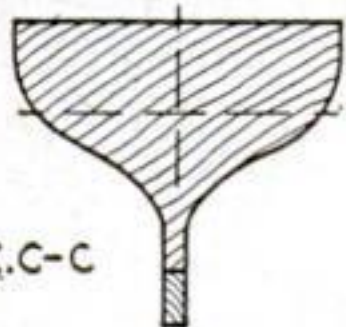
SEC. A-A



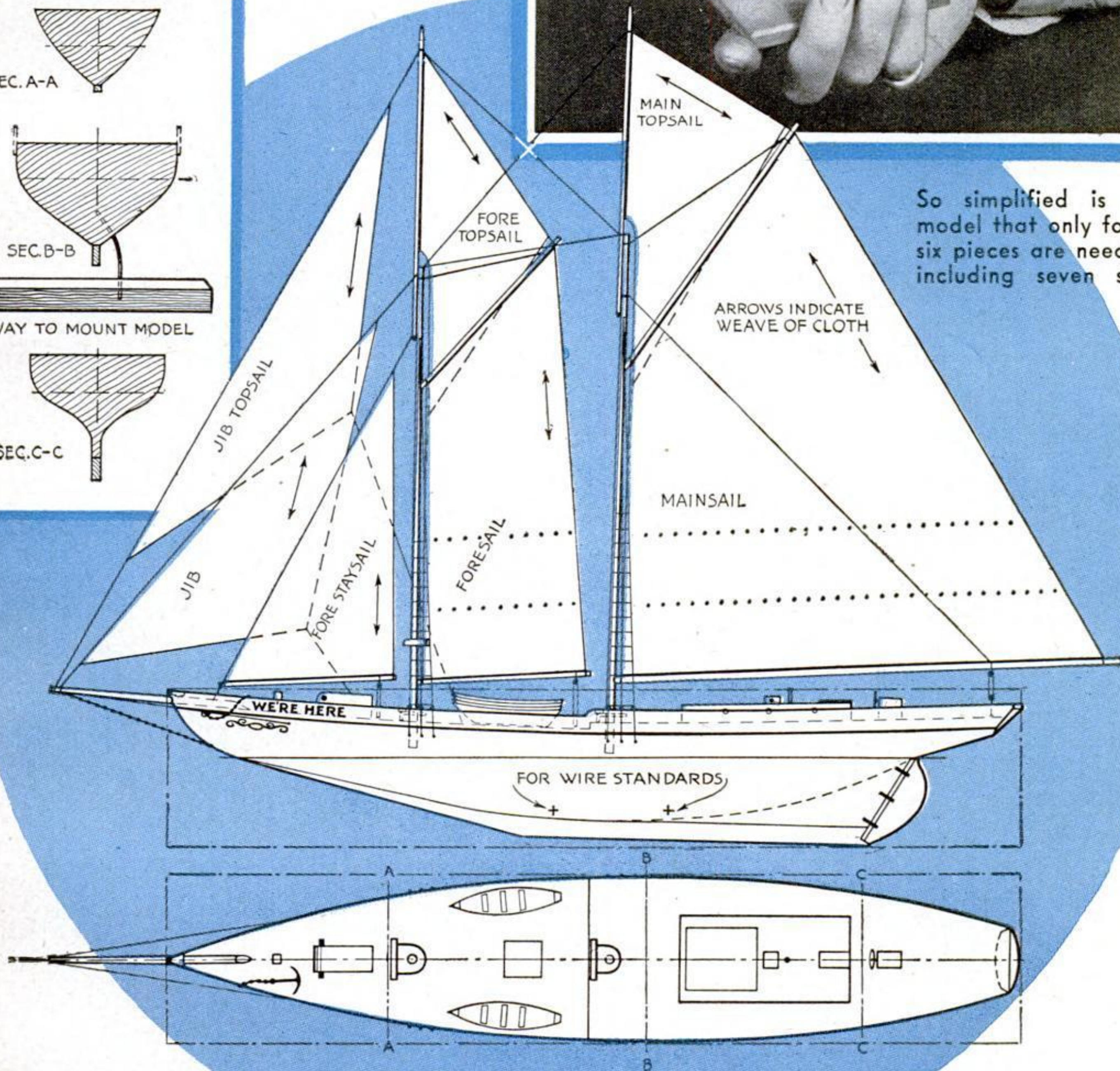
SEC. B-B



WAY TO MOUNT MODEL



SEC. C-C



tached. Draw a light pencil center line the length of the deck and indicate the location of the deck units.

Mark, cut, and glue on the fiber or cardboard bulwarks. Glue the corresponding stern piece to the hull, trim off the excess, and then fit in the stern rail piece, which is thin wood.

The bowsprit should be glued in place, the bulwarks being notched to fit. Cut the tiny triangular bow piece to fit over the bowsprit where the bulwarks come together.

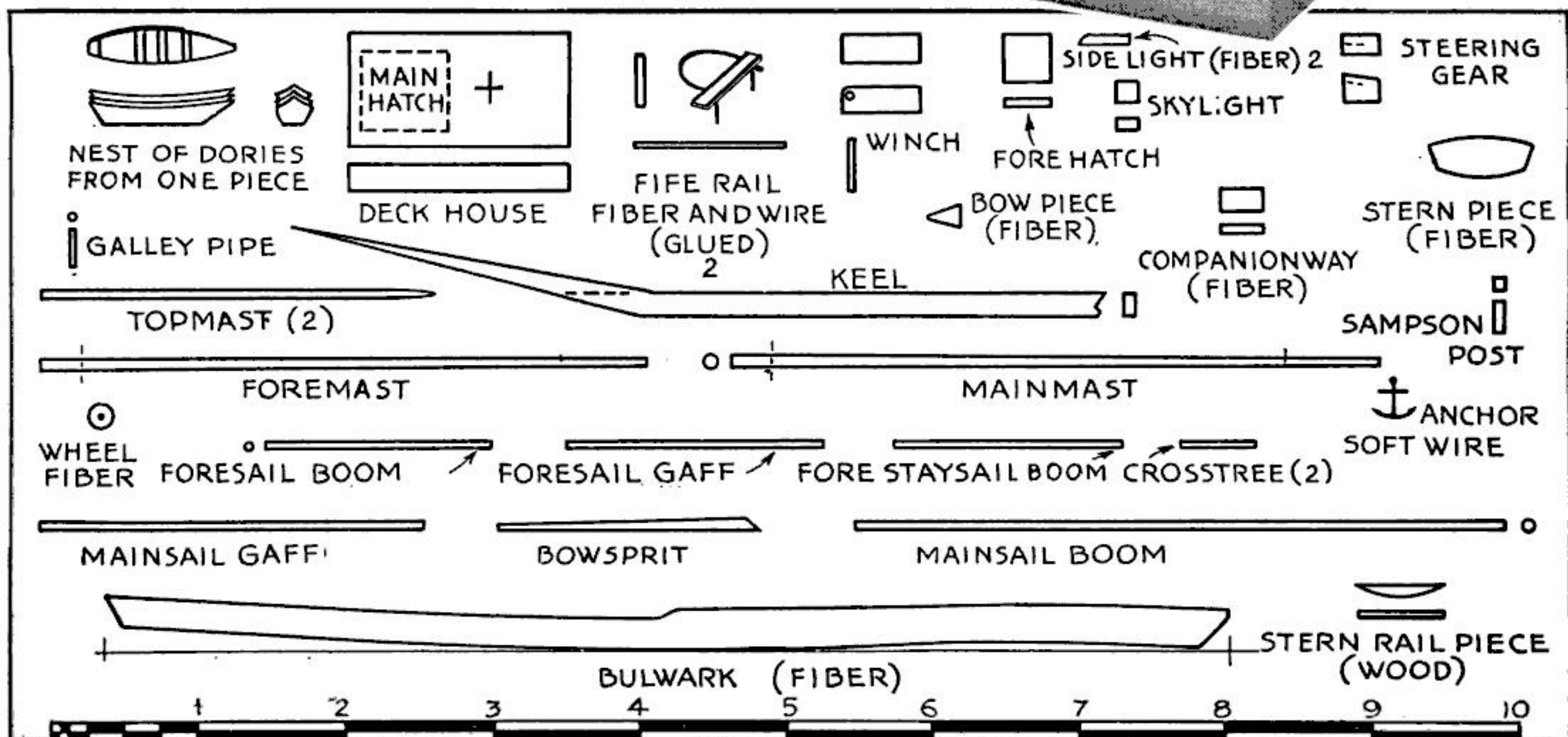
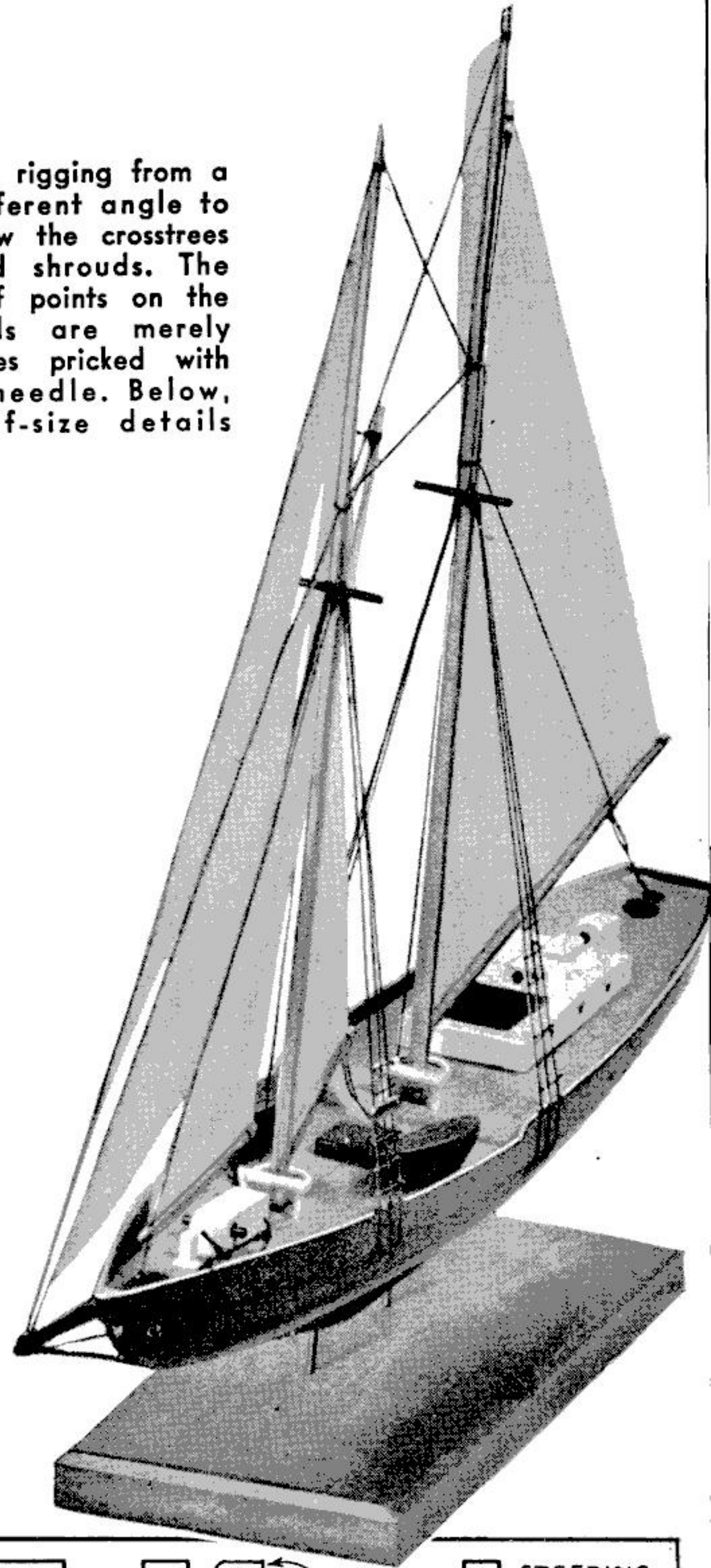
Next attach the deck house, dories, and other fittings. The winch, deck house, and steering gear have small parts that are easier to glue on before these units are set in place. A common pin, cut short, will hold the steering wheel to its block. After the wire fife rails are set into the deck, glue their fiber cross bars in place.

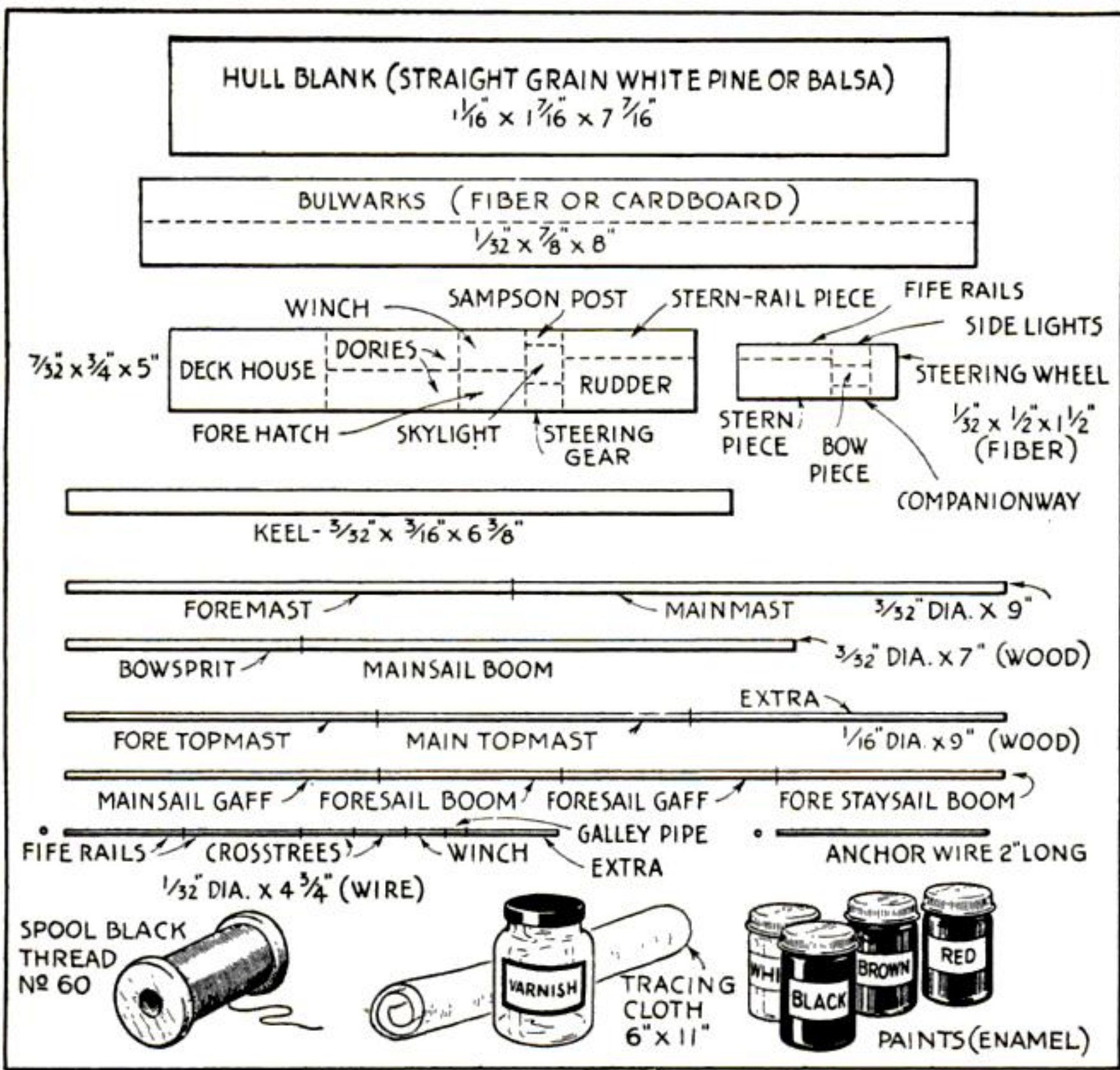
Set and align the masts. You may find it better to attach the topmasts and crosstrees before doing this. Then glue or cement the middle of the three lines for the shrouds to one point on each mast at the crosstree. When dry, spread the lower ends, three on each side, and cement them securely to the bulwarks and hull as shown. Hold the ends tight with the thumb against the keel until the cement has set, after which the ends may be trimmed off. Stick on the ratlines and cut off the ends. Glue on the side-light boards and put a gob of glue at the after end of each to serve as lights. Paint the port (left) one red, the starboard green.

Black cotton thread No. 60 will serve for the rigging of so small a model. The ends can be fastened wherever necessary with a drop of glue or cement if the thread is frayed a little. It is important to have the lines tight.

The bobstay (below the bowsprit) and the

The rigging from a different angle to show the crosstrees and shrouds. The reef points on the sails are merely holes pricked with a needle. Below, half-size details





Here is the list of materials, graphically arranged to show at a glance just what is required and how various pieces are cut up

anchor chains on the original model were made by tying a string of knots in the thread. If desired, real chain may be used. The anchor is made up of three pieces of

wire, held together with cement.

Tracing paper, tracing cloth, or any very thin cloth is suitable for the sails. Make paper patterns first, and cut the cloth so the after edges of all sails curve out a little. If tracing cloth is used and you do not like the bluish hue, it may be removed by dampening with warm water and pressing with a well-waxed iron. Belly the sails to give a picturesque, wind-blown effect.

Varnishing and painting should be done as far as possible before the parts are assembled, as follows: Give the hull a first coat of shellac or flat white paint and rub down. Mark the water line by resting a pencil on a block of wood in the usual manner. Enamel the hull black down to the water line, and copper color below. Make the rudder fittings black. Use clear varnish on deck, masts, and spars. Make the crosstrees black. Deck units are white with black details; dories black or dark brown. One way to put on the name is to

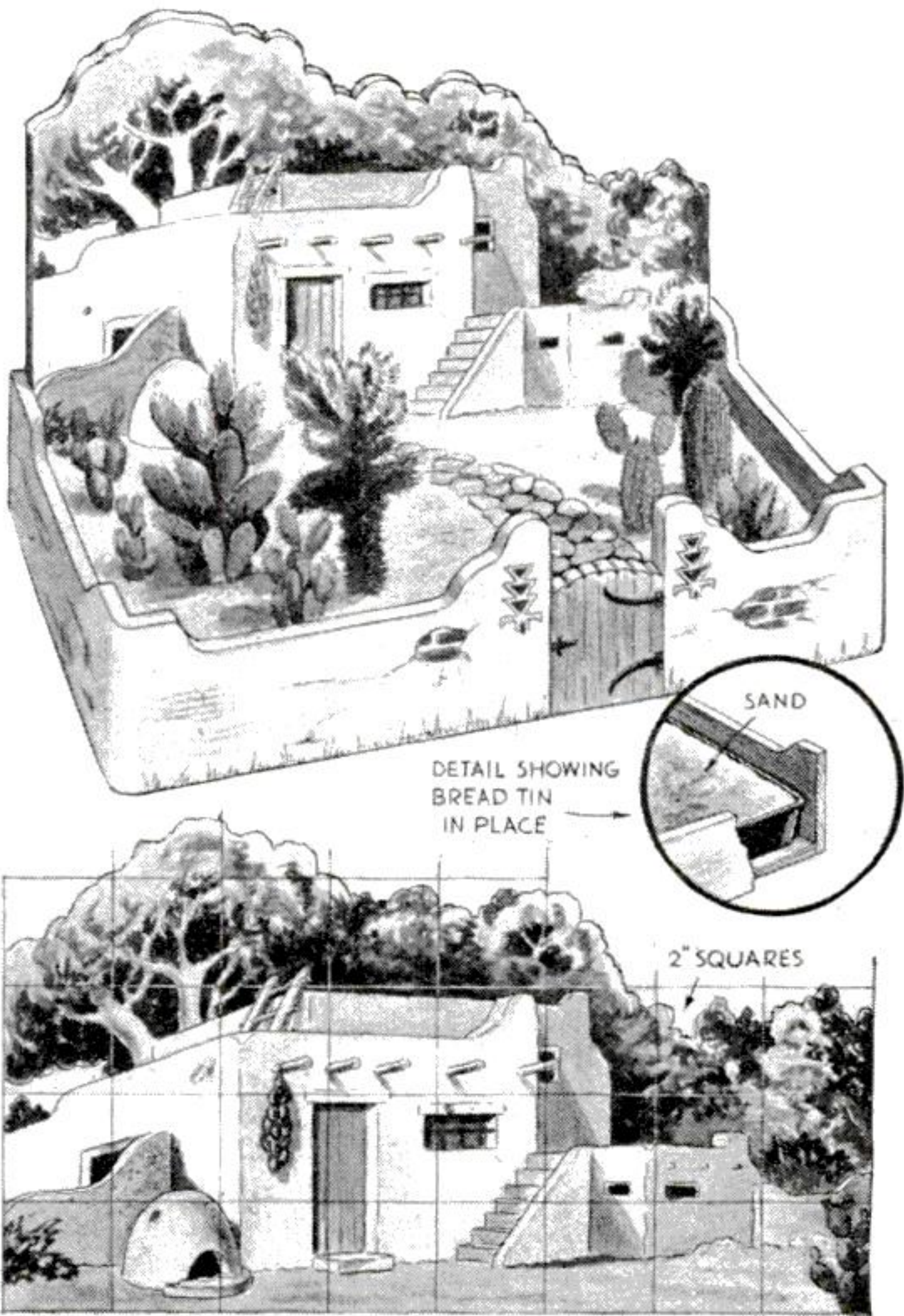
letter it with a fine pen and white ink on a strip of black paper and glue the paper to the bulwarks on each side near the bow, and also on the stern with "Gloucester" below.

Picturesque Window Box for Cactus Plants

SMALL cactus plants can be given an attractive setting by making a window box as shown and painting it to represent a miniature southwestern garden with an adobe house in the background. If a colored picture of suitable size having a desert background can be obtained, it may be pasted on a piece of plywood and cut out to serve as the back of the box; otherwise the scene illustrated may be enlarged by means of the squares and colored realistically. If you are artistically inclined, you may prefer to design your own background.

Paint the gate in front green with black or dark blue hinges, and make the designs on each side of the gate black with a red edge. The remainder should be painted in natural colors, and a little grass may be indicated along the edge of the wall.

Inside the walls, place a flat bread tin, filled with earth and a little sand. Plant the cactus in this, and make a small stone walk from the gate to the door of the house. The smooth stones often used in fish bowls are best for this purpose.—GRAY WOLF.

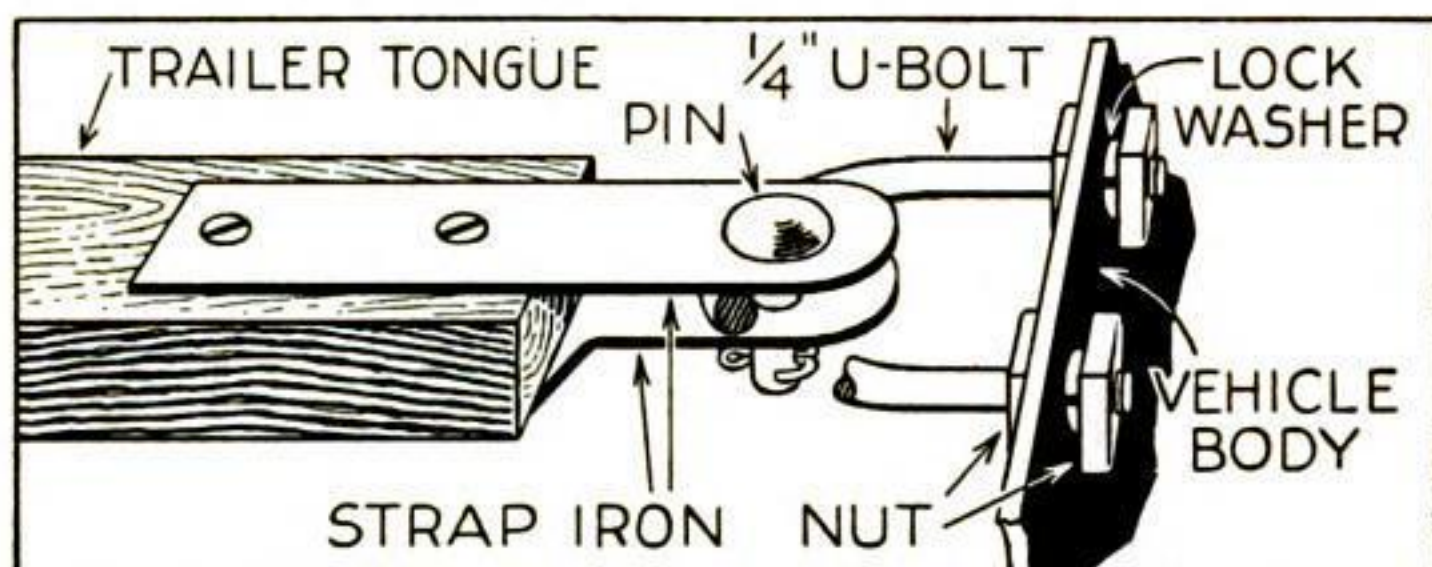




Small Trailer and Hitch for Child's Wagon

A NEAT, sturdy, and safe trailer hitch for children's express wagons, bicycles, and autos can be made from scrap materials as illustrated below.

The trailer itself was built from the following materials: 1 pc. 2" by 4" by 18" and two large nails or spikes for the body support and axles; 1 pc. $\frac{7}{8}$ " by 15" by 18" for the bed; 4 boards $\frac{1}{2}$ " thick for the sides; 2 posts 1" square for the front corner supports; 2 diagonal side braces $\frac{3}{8}$ " by 1"; 1 pc. oak 1" by 1" by 20" for the tongue; and 2 stove bolts for fastening tongue to trailer bed. Wheels of any size may be used, but larger ones provide more road clearance and are a necessity for rough ground. Wheels similar to those on the towing vehicle are best.—DAVID A. BUTLER.



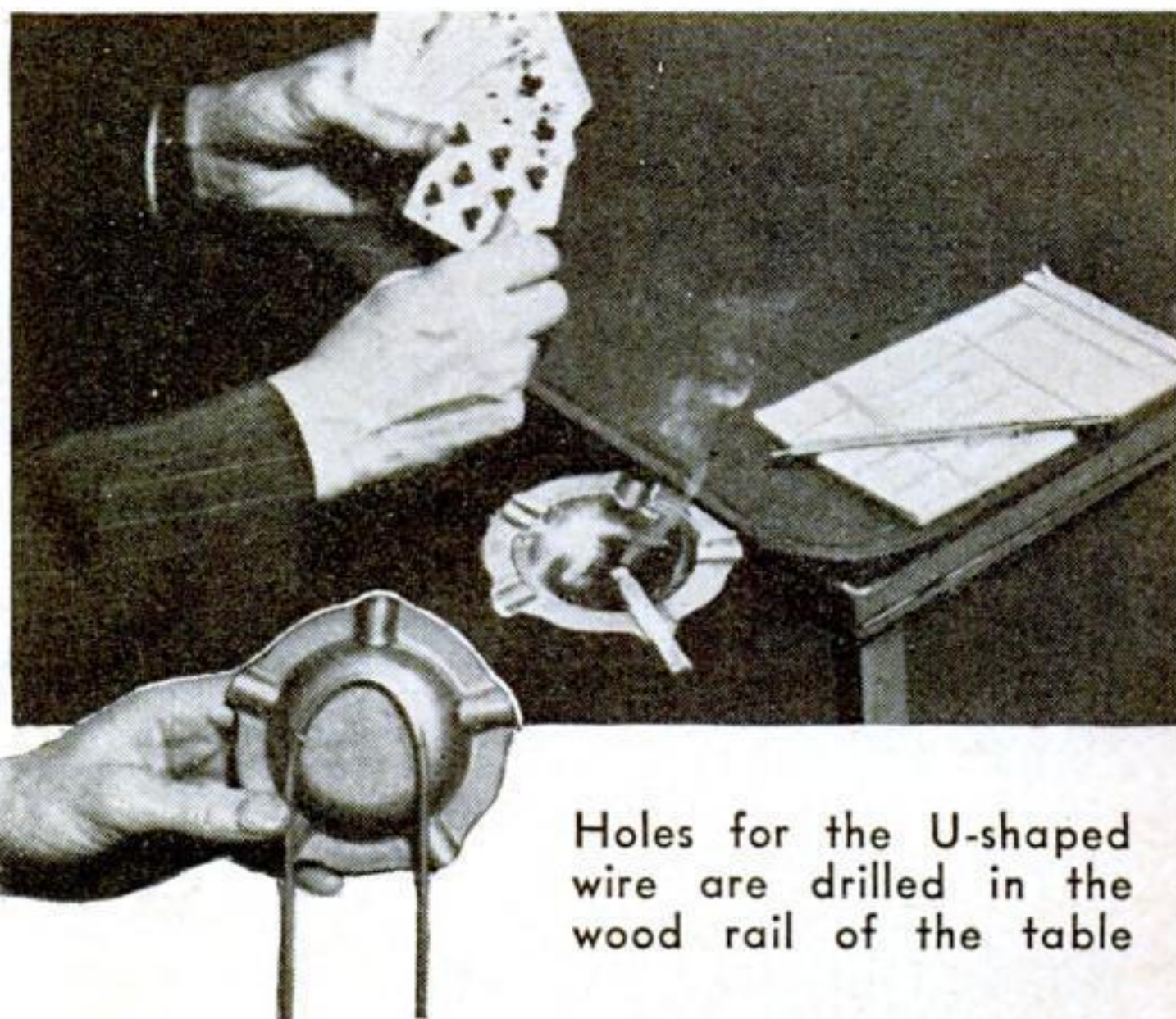
Small Parts Kept in Match Boxes

INSTEAD of having a junk box for very small metal parts, keep them sorted in small penny match boxes, which can be labeled and kept in order.—E. A. BOWER.

Metal Ash Trays Mounted on Edge of Card Table

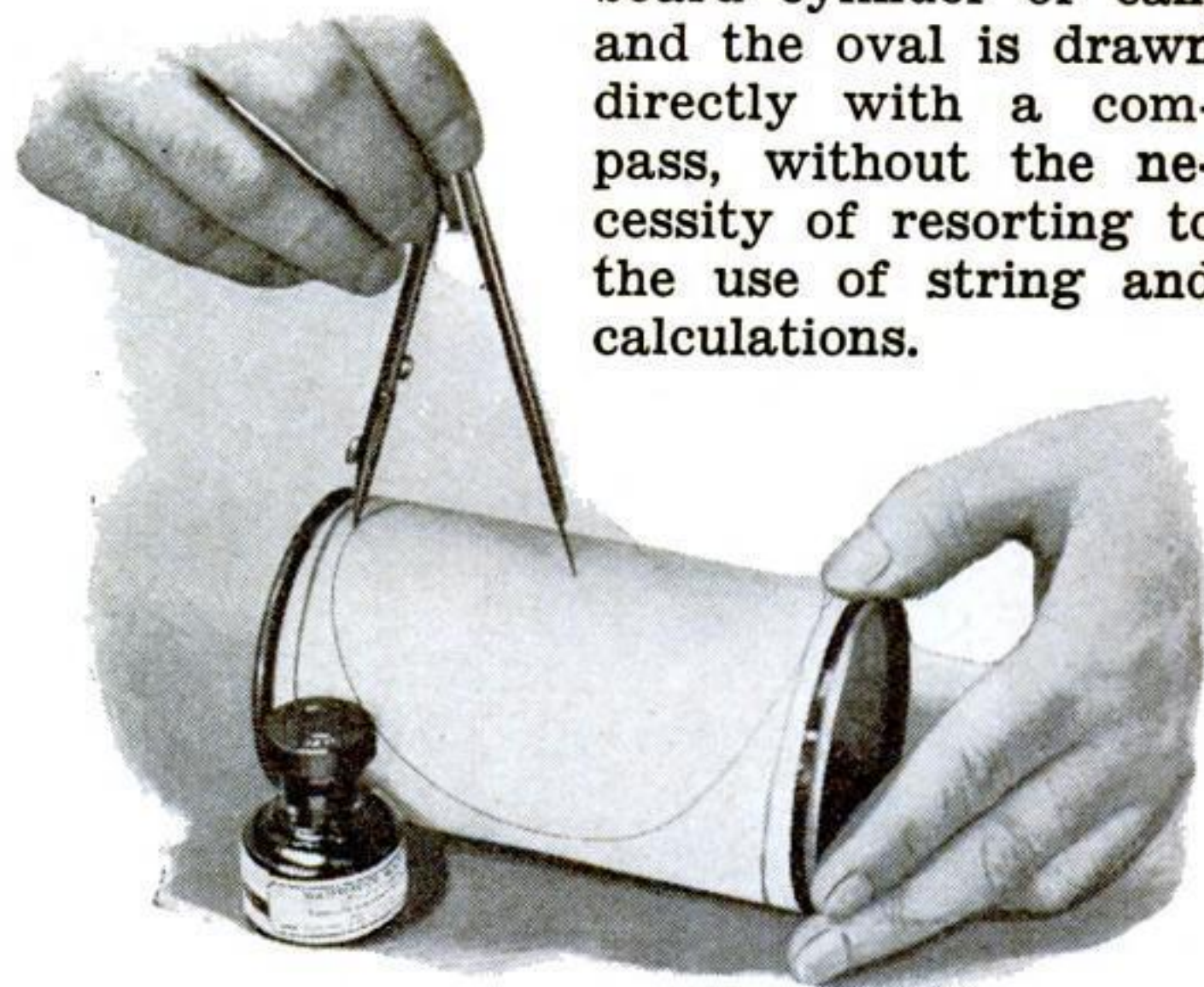
IF A U-SHAPED piece of heavy wire or light metal rod is soldered to the bottom of a metal ash tray as shown, the tray can be mounted on the edge of a card table simply by drilling two holes in the wooden rail of the table near the corner. The holes should be a sliding fit for the wire. This leaves the table top unencumbered when ready to play.

When the table is of such a type that it is not desirable to drill holes in it, rivet or solder a piece of flat brass about $\frac{1}{16}$ " thick and 1" wide to the bottom of the tray instead of using wire. Then screw another piece of flat brass under the table, with washers to space it out far enough so that the projecting end of the strip on the tray can be slipped snugly in place.—BERTRAM BROWNOLD.



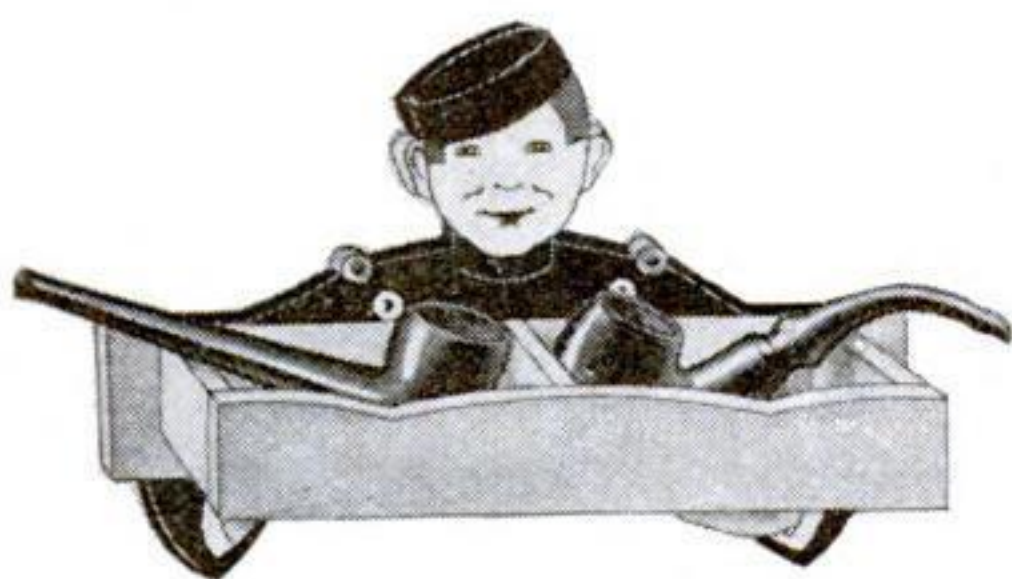
Drawing Ovals with a Compass

ALTHOUGH it is an old trick, many home workers do not seem to be familiar with the method illustrated below of drawing ovals. A sheet of paper is wrapped around a cardboard cylinder or can, and the oval is drawn directly with a compass, without the necessity of resorting to the use of string and calculations.

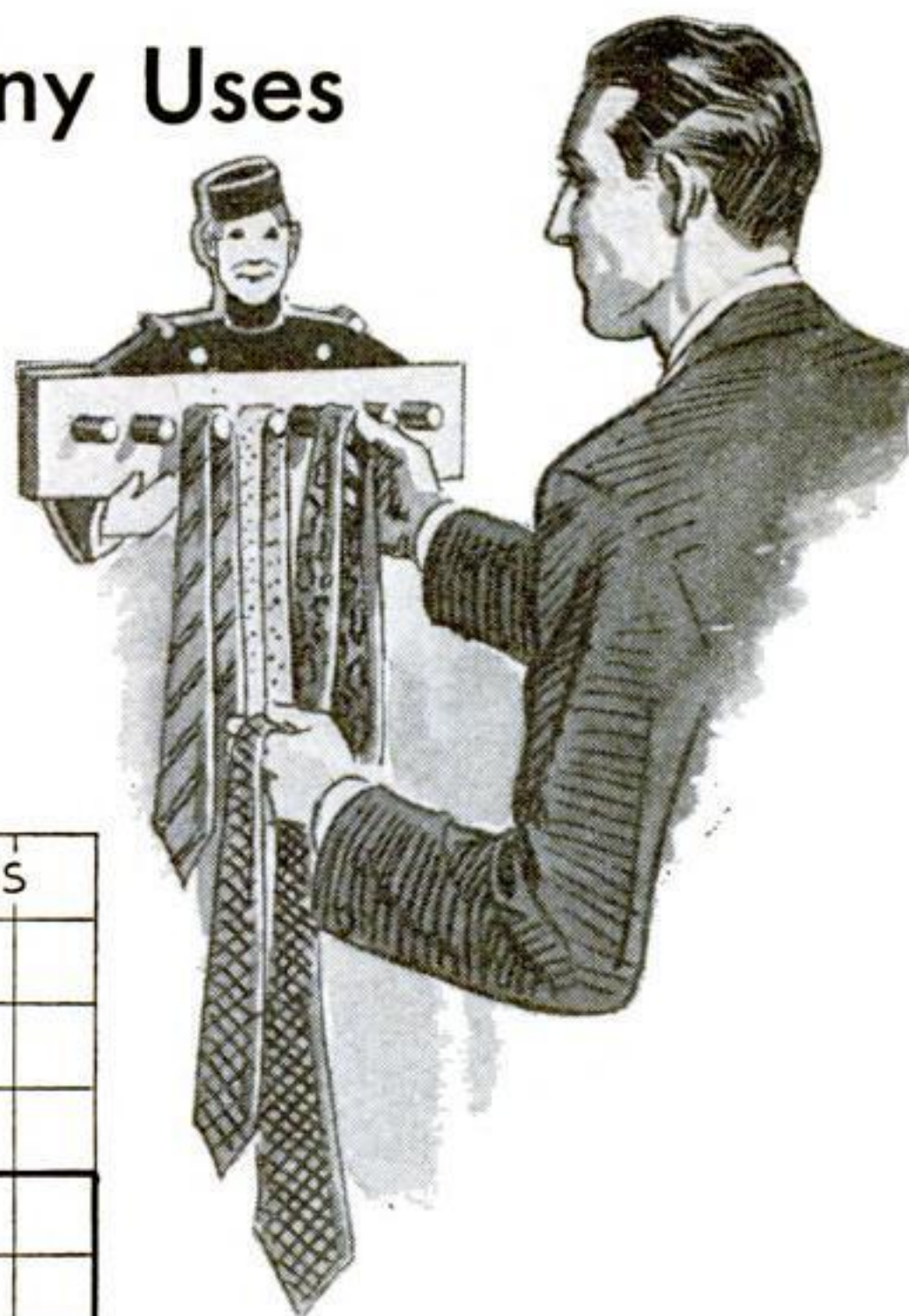
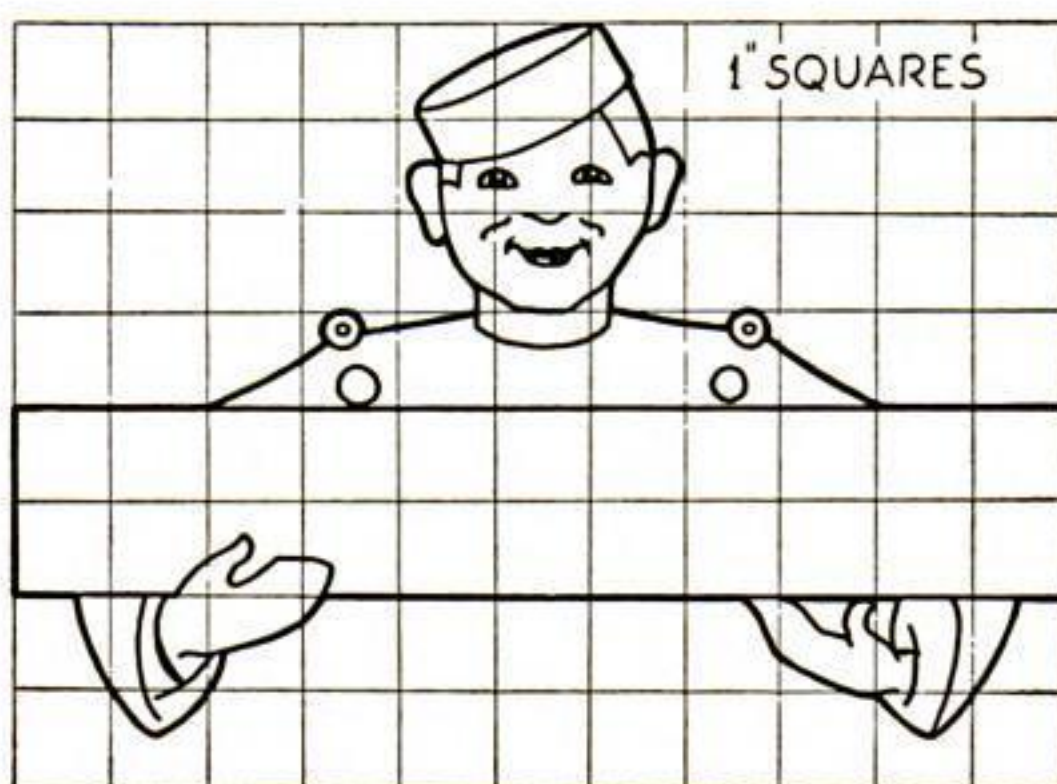


Novel Bell-Boy Wall Rack Has Many Uses

THIS amusing little rack is hung on the wall by nails or thin screws through two buttons of the bell boy's uniform. With a row of pegs, the rack serves as a necktie holder; with a row of hooks, it might hold various small articles such as hot lid lifters or small kitchen gadgets; with the addition of a shelf, it would be a tiny whatnot; with suitable pockets, it becomes a pipe rack. Cut the back part of the rack from wood at least $\frac{1}{2}$ " thick if hooks or pegs are to be used. Thinner wood may be used if there is to be a shelf or pockets.—HAZEL F. SHOWALTER.



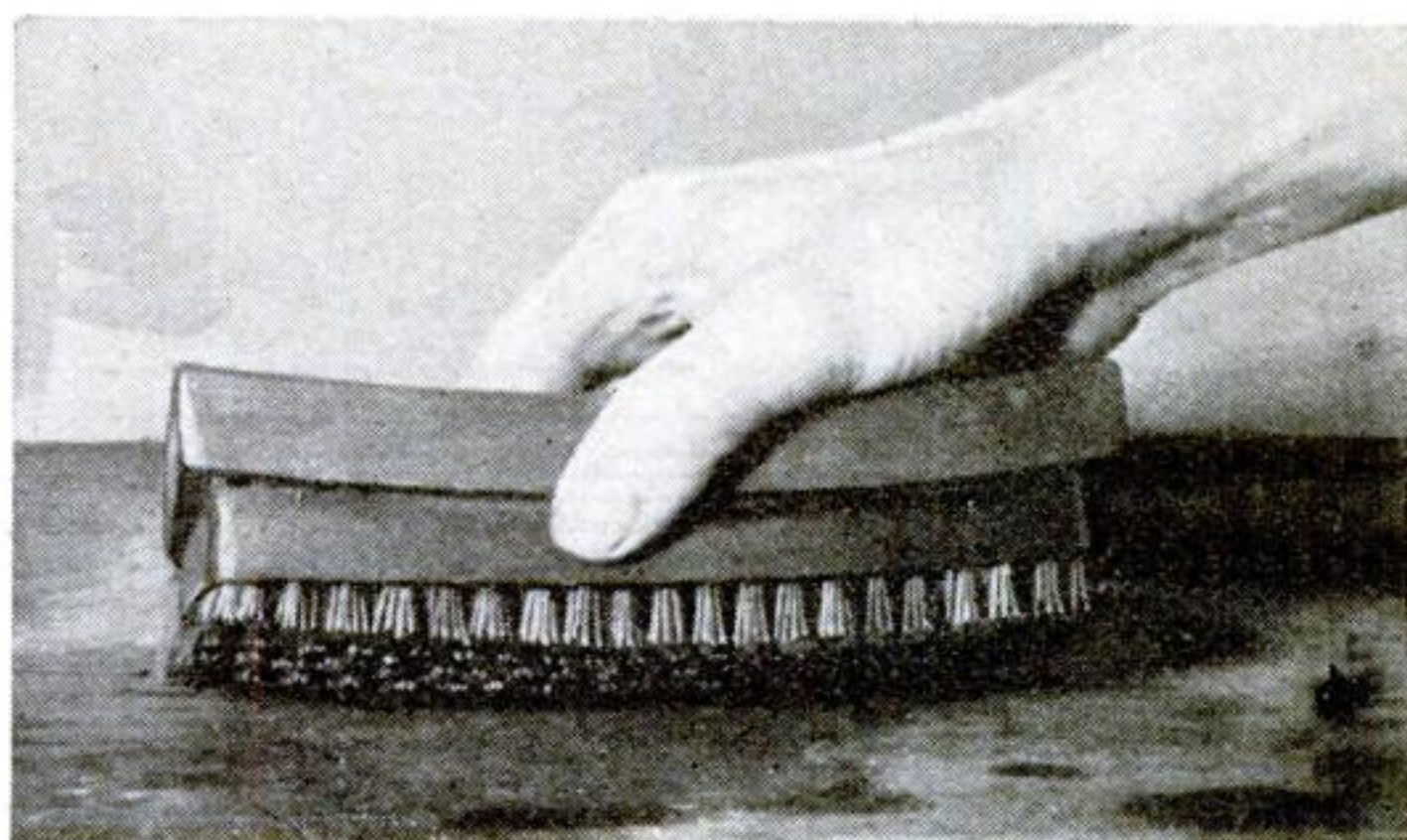
Above, how the bell boy can be adapted as a pipe rack and, at right, the drawing



When a row of dowel pegs is added, the rack serves as a unique necktie holder

Old Display Stand Makes Adjustable Bench Lamp

IF YOU can lay your hands on a discarded adjustable stand of the type shown below—they are used in shops to display apparel—it may easily be converted into a bench lamp that will make working after dark a pleasure. The threads at the top of the sliding rod were cut off, and the end threaded with $\frac{1}{8}$ " pipe threads to receive a standard $\frac{1}{8}$ " swivel joint. To this was attached a push-through socket and a reflector of the kind used on gooseneck desk lamps.—HAROLD P. STRAND.

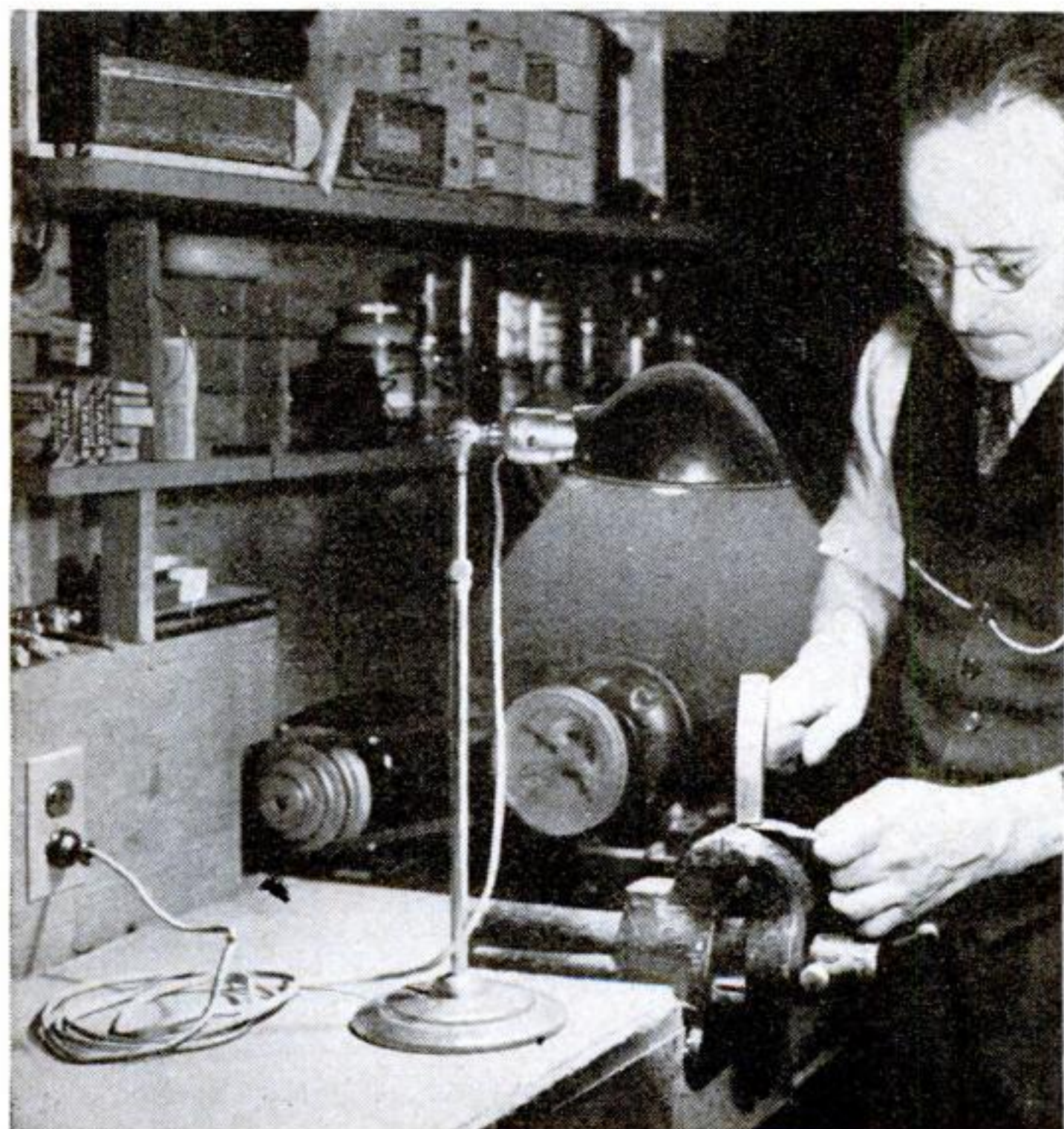
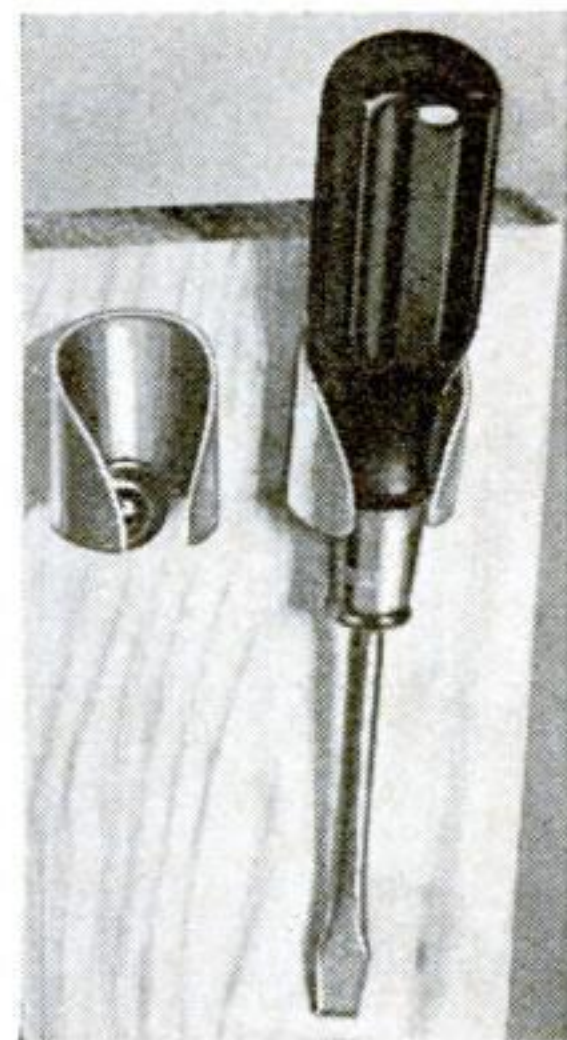


Taped Wire Brush Protects Hands

SEVERAL turns of friction tape wrapped firmly around the edges of a wire brush just under the wooden back as shown above will afford protection for the fingers against bent or broken wires and help to keep the bristles in place.

Neat Aluminum Tool Holders

ALUMINUM plates from discarded variable radio condensers may be made into neat tool holders by bending them and fastening each of them with a screw and washer to the backboard of the workbench. Being soft, the plates are easily cut to smaller sizes if necessary.



Dog's Sun House

**ADMITS
HEALTH-GIVING
ULTRA-VIOLET
RAYS**



Hood raised to admit sunlight through the roof

YOU may have noticed how your dog always seeks a spot of sunlight on the carpet in the morning. A little sun house of his own will therefore be greatly appreciated, and it will contribute both to his comfort and good health.

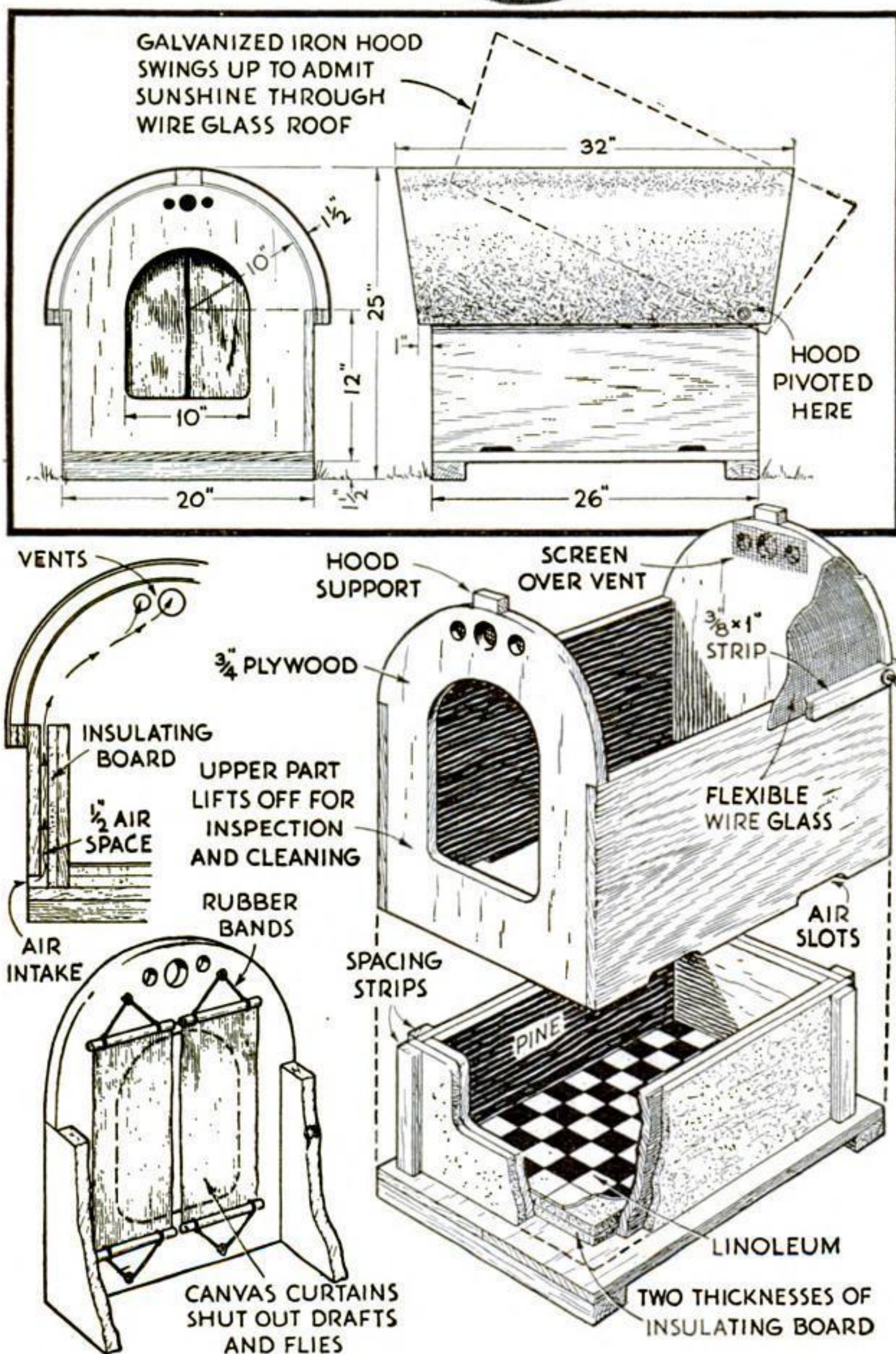
If it becomes too hot at noon, the hood of the unique dog house illustrated can be lowered to provide shade and a cooling air space.

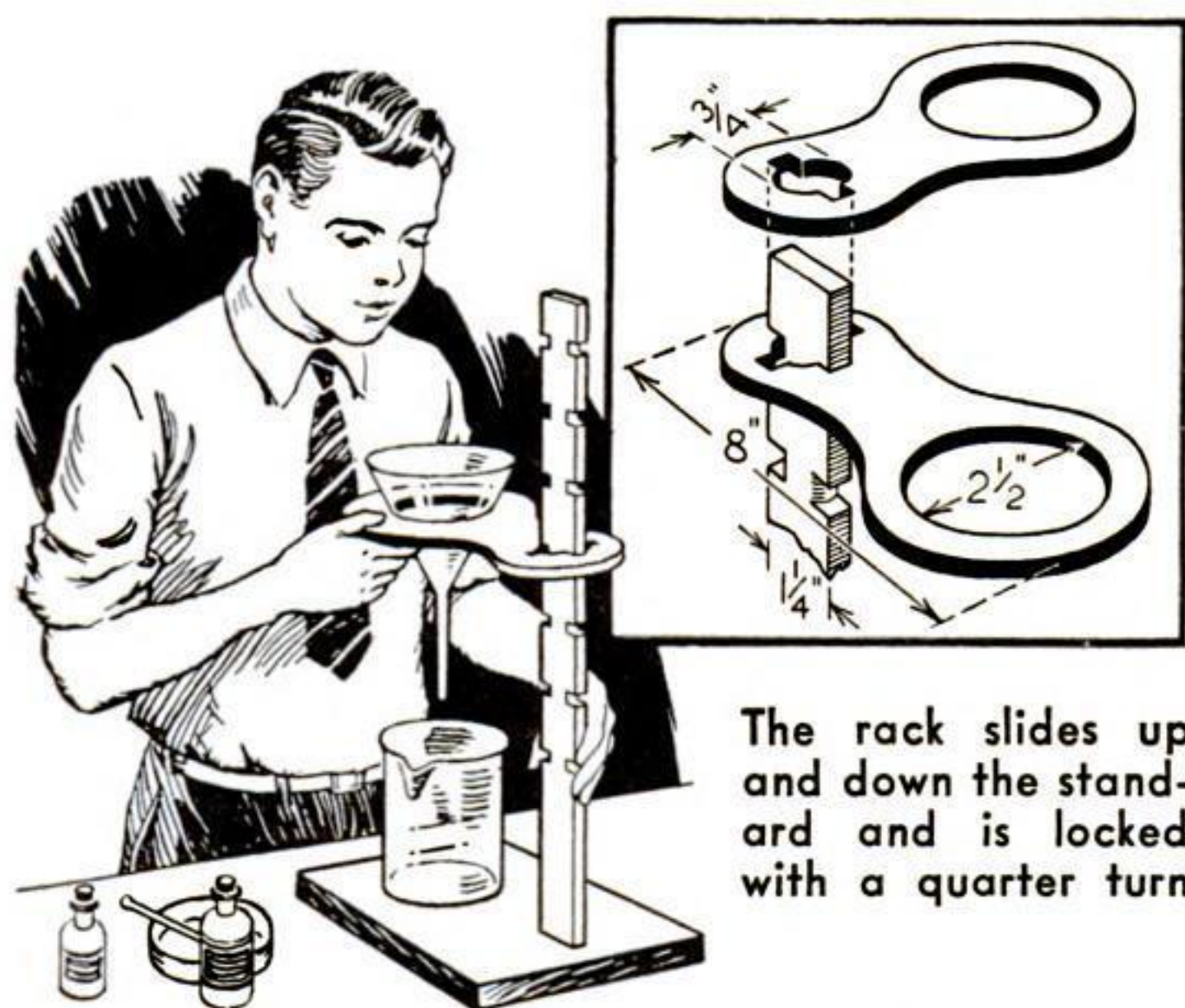
In severe winter weather a quilted pad placed between hood and wire-glass roof will keep the house comfortable because it is well insulated otherwise. Flies, the bugaboo of all dogs in summer, are excluded by the canvas curtains, and good ventilation without drafts is assured by the double-wall construction. Note also that the upper part lifts off the base, giving access for cleaning and inspection.

Ordinary pine lumber may be used throughout, although if a weather-proof type of $\frac{3}{4}$ " plywood is obtained for the ends, it will permit making each in one piece and therefore simplify the construction. Flexible cellulose screen-glass, which is inexpensive and easily obtained, admits health-giving ultra-violet rays. It should be fastened with copper tacks over the curved portion of the roof. Brown or khaki canvas curtains are hung on dowels suspended from screw eyes on rubber bands, which keep them taut but admit the dog easily. Excelsior is recommended for covering the linoleum on the floor, as it can be removed and burned weekly. Note that there are two thicknesses of insulating board beneath the linoleum.

The roof hood is made of galvanized iron. You can cut and bend it to shape yourself or, if necessary, have that part of the work done by a tinsmith.

The dimensions given are suitable for a fox terrier or dachshund. Larger dogs need more room.—HI SIBLEY.



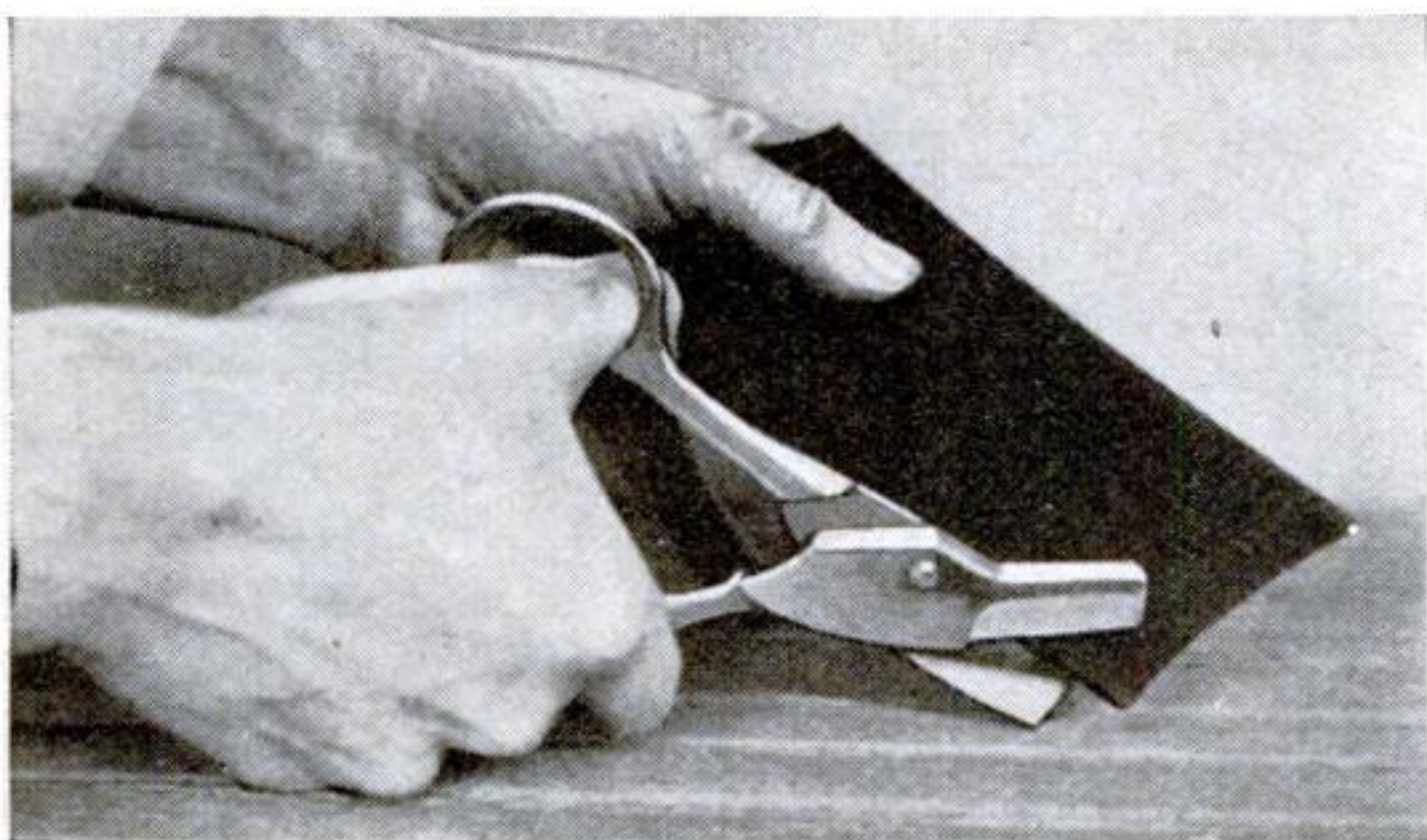


The rack slides up and down the stand and is locked with a quarter turn

All-Wood Funnel Holder Is Easily Adjusted

MADE entirely of wood, the funnel stand illustrated can be adjusted for height without using a thumbscrew, clamp, or other device. The funnel rack is merely turned 90 deg. to one side or the other and moved up or down the standard until opposite the desired notches, when it is swung back into position.

The upright is a 1/4" by 1 1/4" stick of convenient height notched at 2" intervals as shown. It is mortised into a baseboard 4 1/2" by 8", and the joint is reinforced with a long thin screw or nail. The rack is made as detailed from a piece of thin plywood about 3 1/2" by 8".—H. L. ARMITAGE.

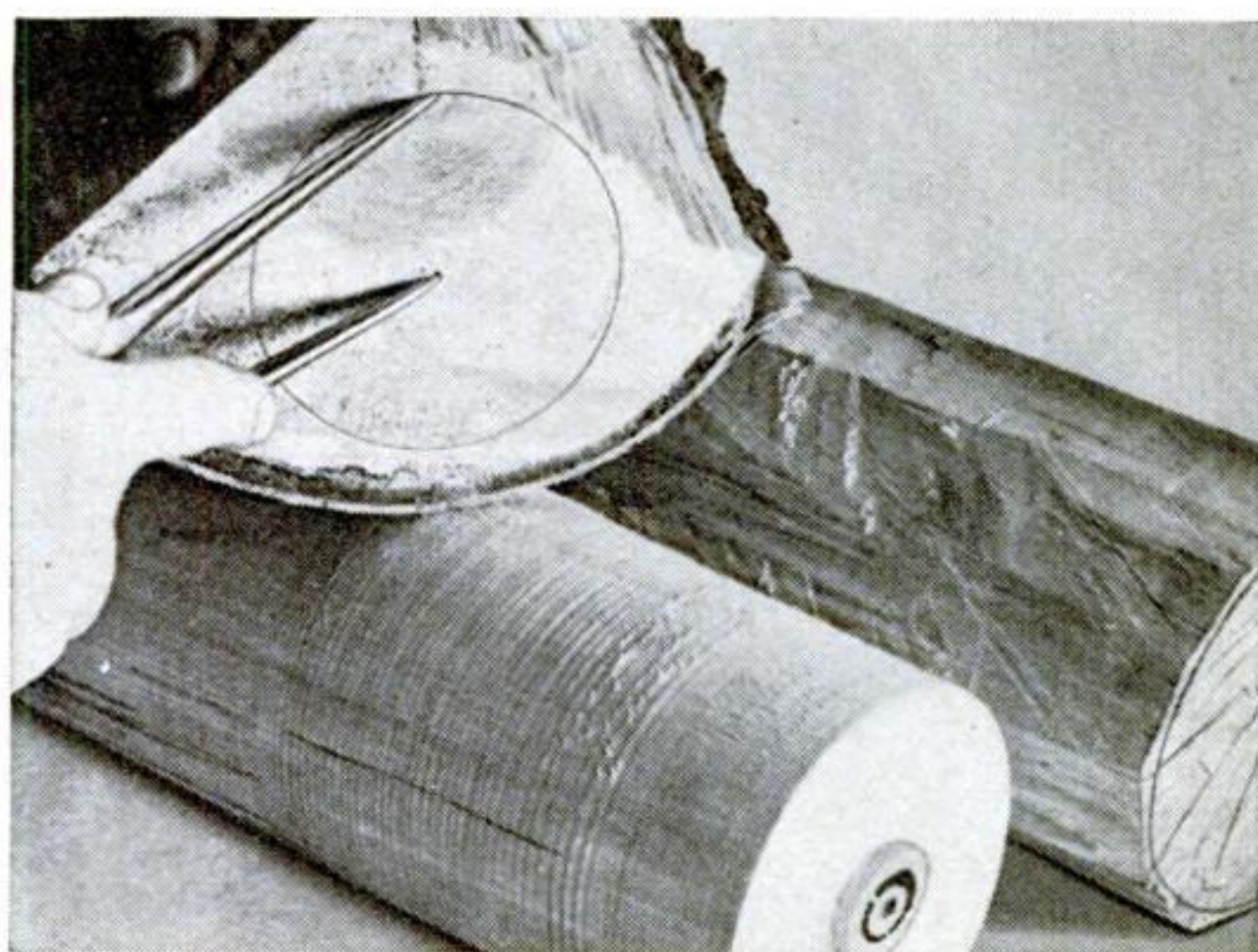


Tin Shears from Old Scissors

IF YOU have no regular metal-cutting shears, a substitute for light work may be made by cutting short the blades of an old pair of large scissors. This tool is well adapted for following sharp curves. Take care, in hack-sawing the blades, not to attempt to cut through the inner surface, which is hardened. Cut nearly to this surface, then break the points off by bending them over. Grind the ends smooth.

Selected Cordwood Provides Cheap Stock for Turning

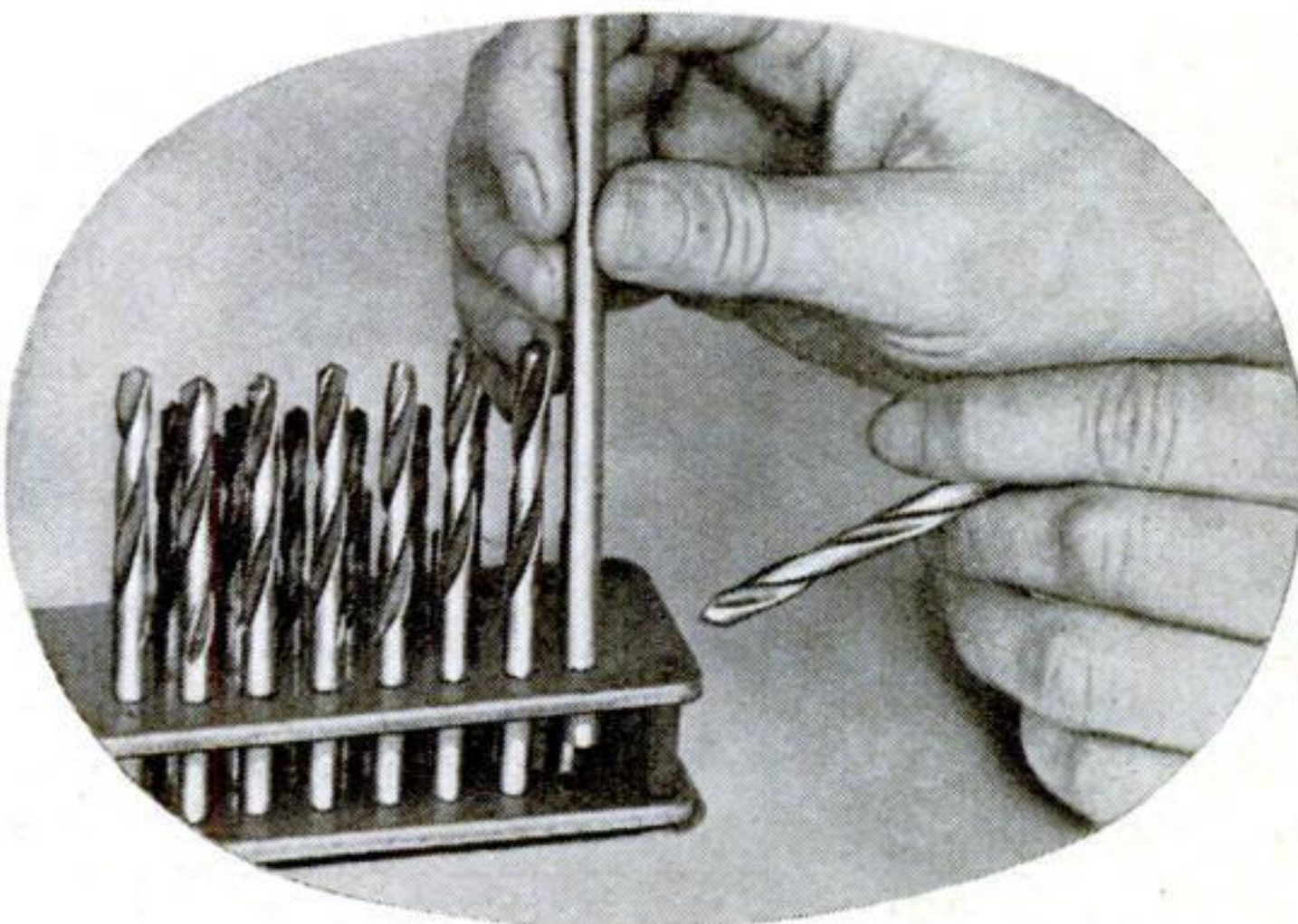
BIRCH, cottonwood, and other wood suitable for common wood turnings can be obtained very cheaply in many localities by selecting good, sound pieces of cordwood. Cut a section off a little longer than necessary, draw a circle on each end, and chop the wood nearly round with a sharp hatchet. Then put it in the lathe and rough it into a cylinder as shown. It is surprising how many uses one can find for this type of material. The writer always has two or three sticks laid aside in his shop for seasoning so they will be ready when needed.—R.O.L.



After circles have been marked on the ends of the cordwood, it is chopped nearly round, then turned

Choosing a Twist Drill to Suit Any Size Round Stock

WHEN twist drills are kept in an accurately made metal stand, it is easy to find the right drill to use for making a hole to suit any size of round stock. Simply remove a drill that looks to be the proper size and try the round stock in the hole.



BUILDING A Barrel Chair

a quaint, useful, and
very inexpensive piece
of furniture



The completed chair is comfortable and has a cozy, cheerful look. Left, drilling screw holes for the seat ring

OF ALL the furniture it is possible for an amateur to build, few if any pieces are at once so simple to construct yet so useful and satisfactory as a barrel chair. The cost of materials is nominal, and several members of the family may take a bow for their part in its production.

Comfortable arm rests, a boxed seat cushion on a webbing frame, and ample storage space under the seat are the outstanding features of the chair illustrated.

First, get your barrel—a squatty one that is extra fat and bulging in the middle. The one shown is an empty powdered soap barrel obtained at a restaurant; it is 28" high, 20" in diameter at top and bottom, and 24" in diameter at the middle.

On the bottom, screw the cross reënforcing cleats of $\frac{3}{4}$ " softwood, 4" wide. Then apply four metal furniture slides close to the outside ends.

Next, draw a pencil line around the barrel 14" from the floor to indicate the seat line. Mark out the pattern of the chair frame above the seat line. The top of the back measures 16" across, and the cut is made down to the top of the metal hoop, in this case 8" from the top. The front opening between the sides is 22" across and is cut down to the seat line. Before sawing through the metal hoops, drill or punch holes through the metal just inside the lines and fasten the hoops tightly to the staves with rivets or nails clinched on the inside of the barrel. Both a compass saw and a hack saw will be required for cutting out the chair pattern.

Two rings must be cut from a piece of five-

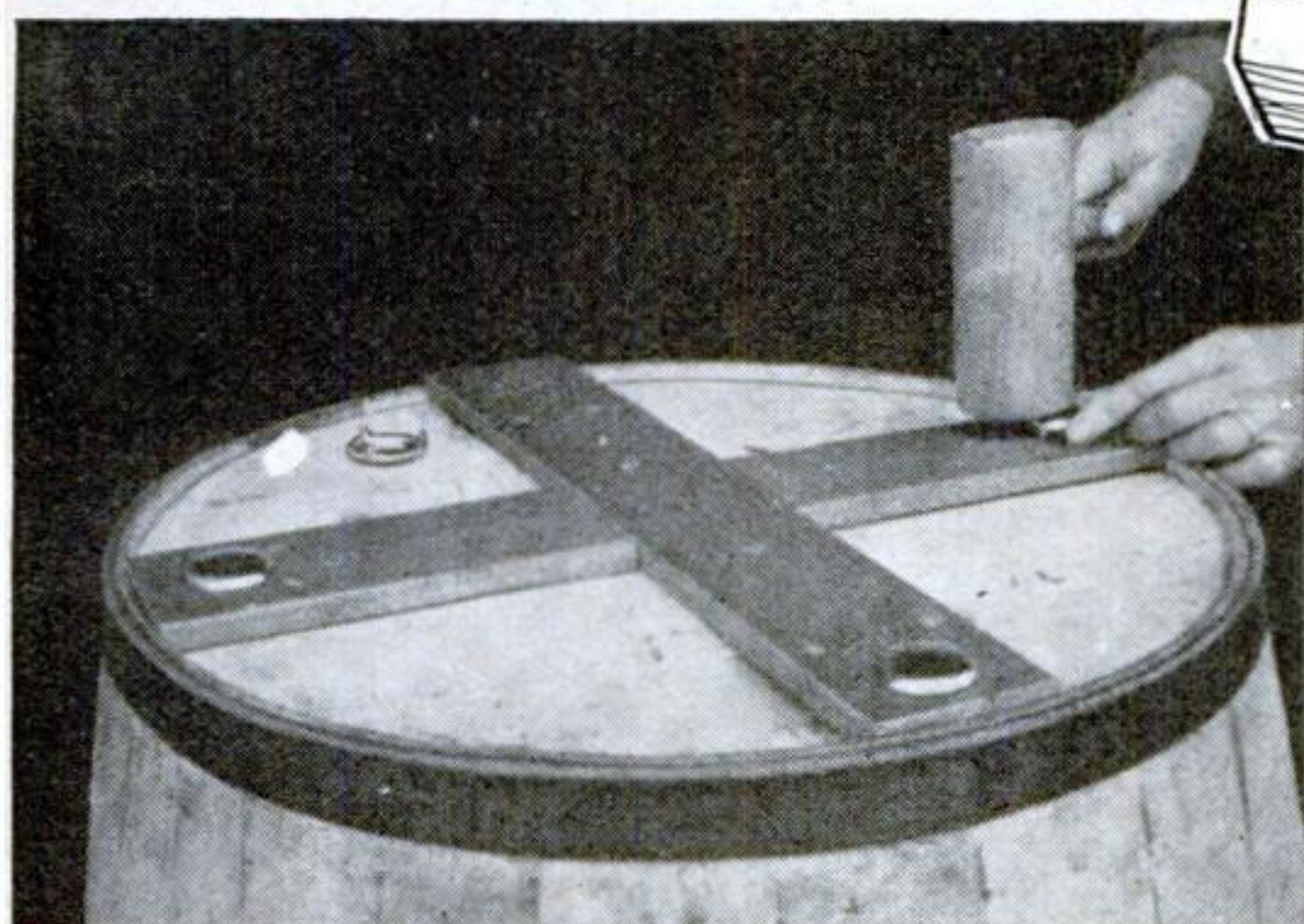
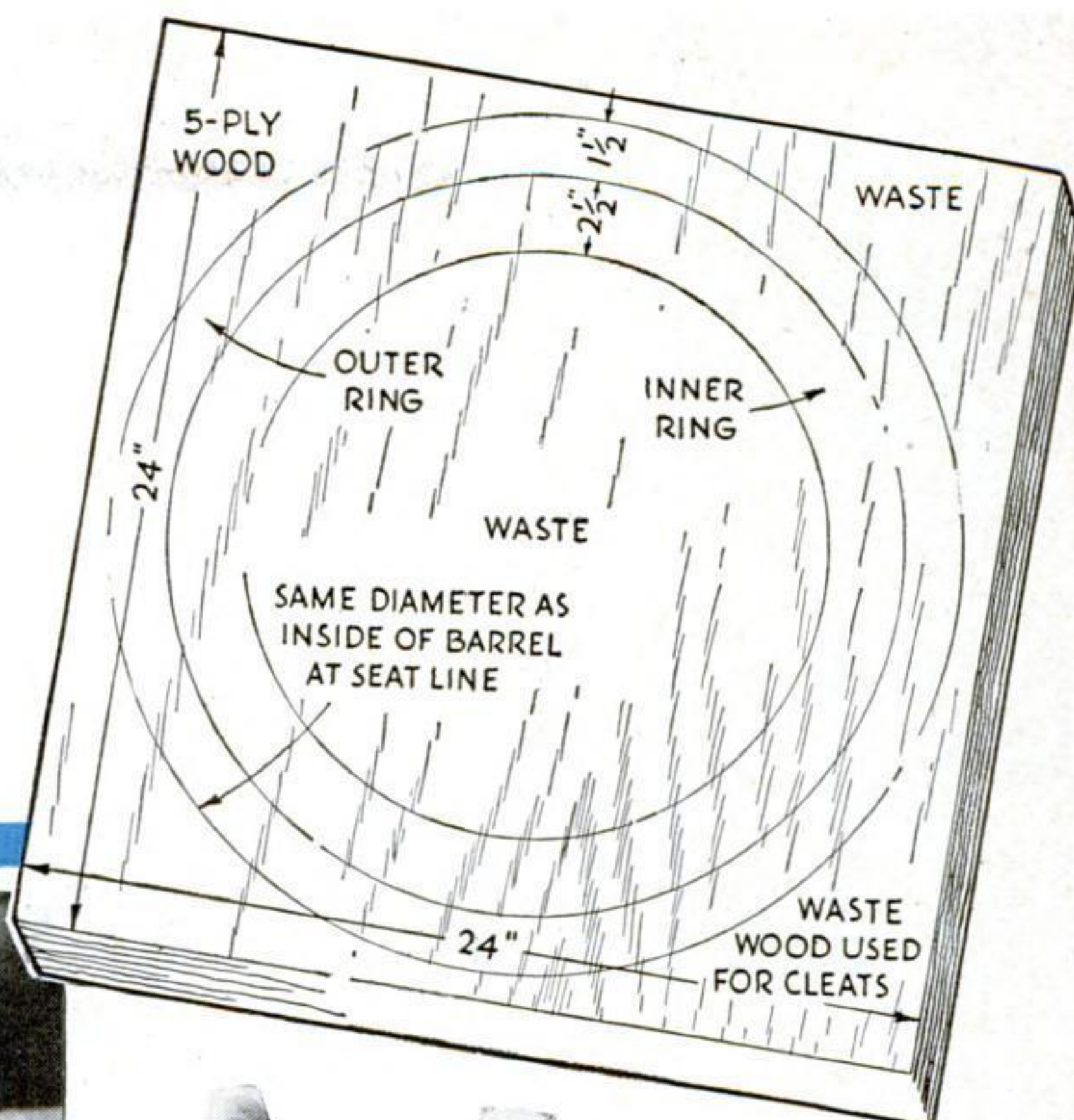
MATERIALS for FRAME

- 1 wooden barrel about 28" high and 24" in diameter at middle.
- 1 pc. 5-ply wood 24" by 24" for seat rings.
- 2 pc. softwood $\frac{3}{4}$ " by 4" by 20" for reënforcing cleats.
- 2 pc. softwood $\frac{3}{4}$ " by 6" by 12" for arms.
- 4 nickel-plated furniture slides, 1 $\frac{1}{8}$ ".
- 4 bracket-type corner irons, 2" by 2", with 1" screws.
- 4 doz. 1 $\frac{1}{2}$ " No. 6 wood screws for ring and cleats.

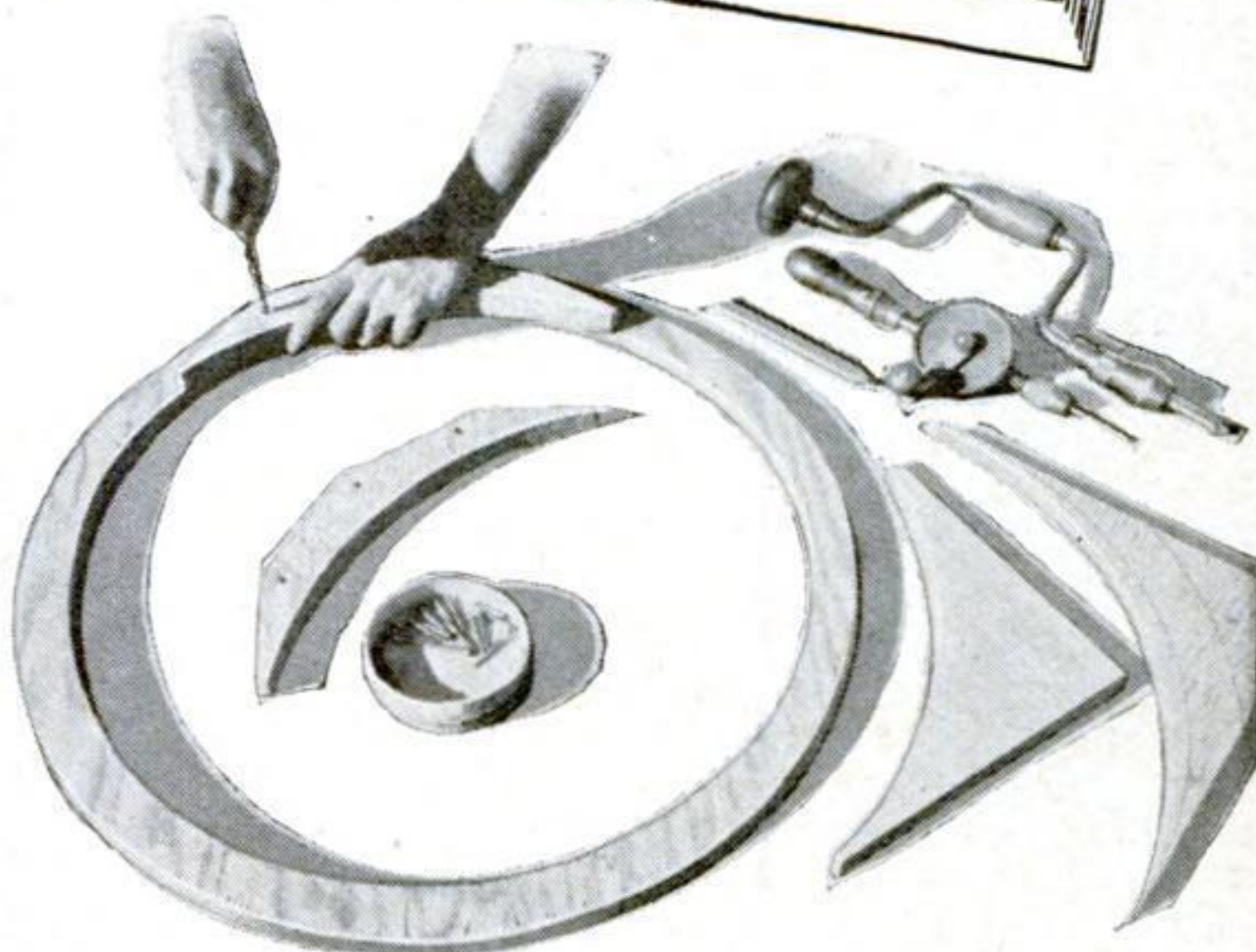
By W. W. WHEATLY

ply wood as shown in the drawing. Make cleats from the waste wood cut away at the corners, and attach them to the underside of the larger or outside ring as indicated in one of the photographs. This ring is then screwed securely in place through each stave to draw the barrel rigidly together and provide a support for the inside seat ring.

The pattern for the arms is now sawed out from two pieces of softwood $\frac{3}{4}$ " by 6" by 12". The offset at the front allows for a pleasant curve, and the back should curve rather sharply where it joins the

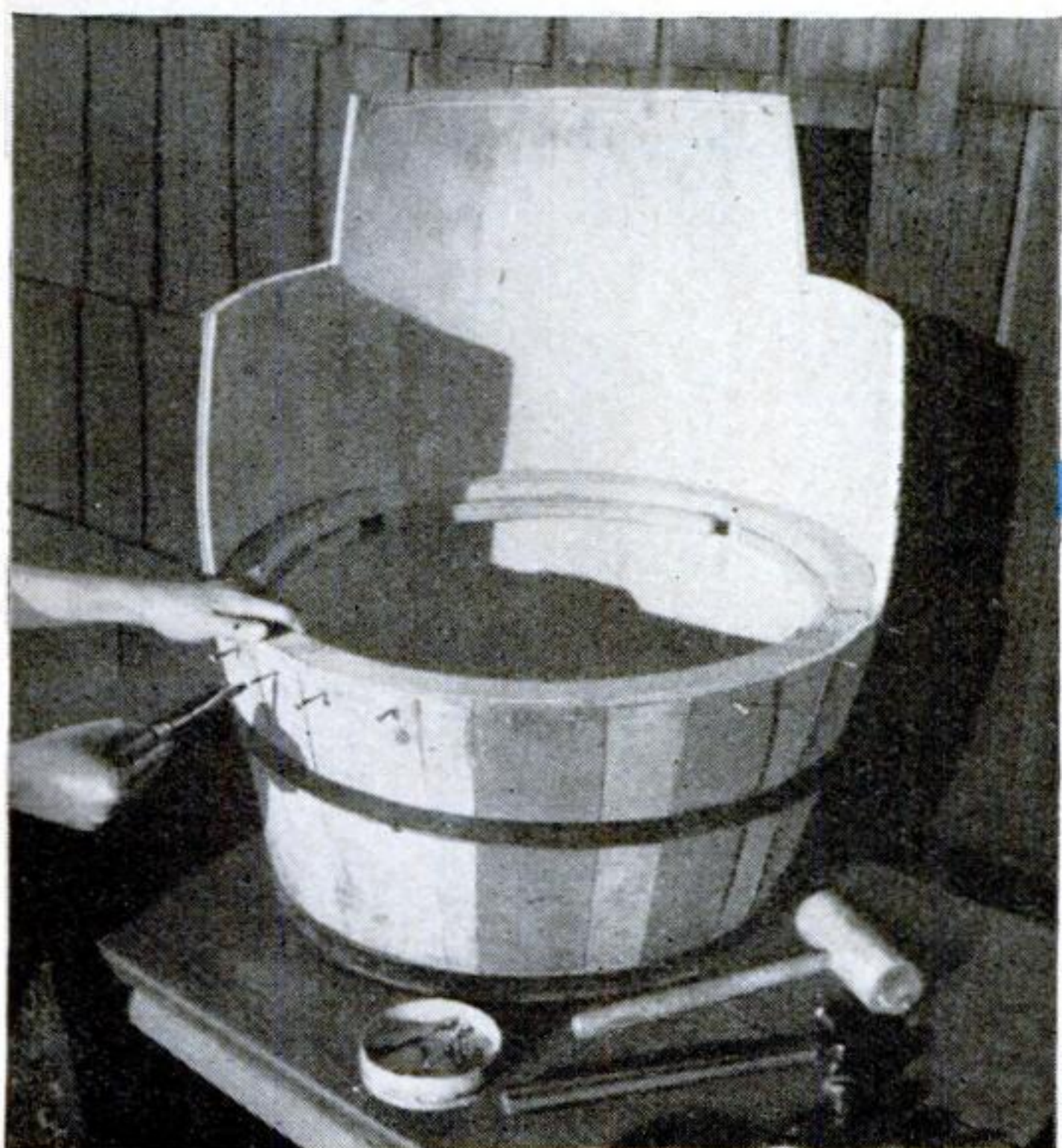


The first step is to reinforce the bottom with cleats and fasten on four metal furniture slides

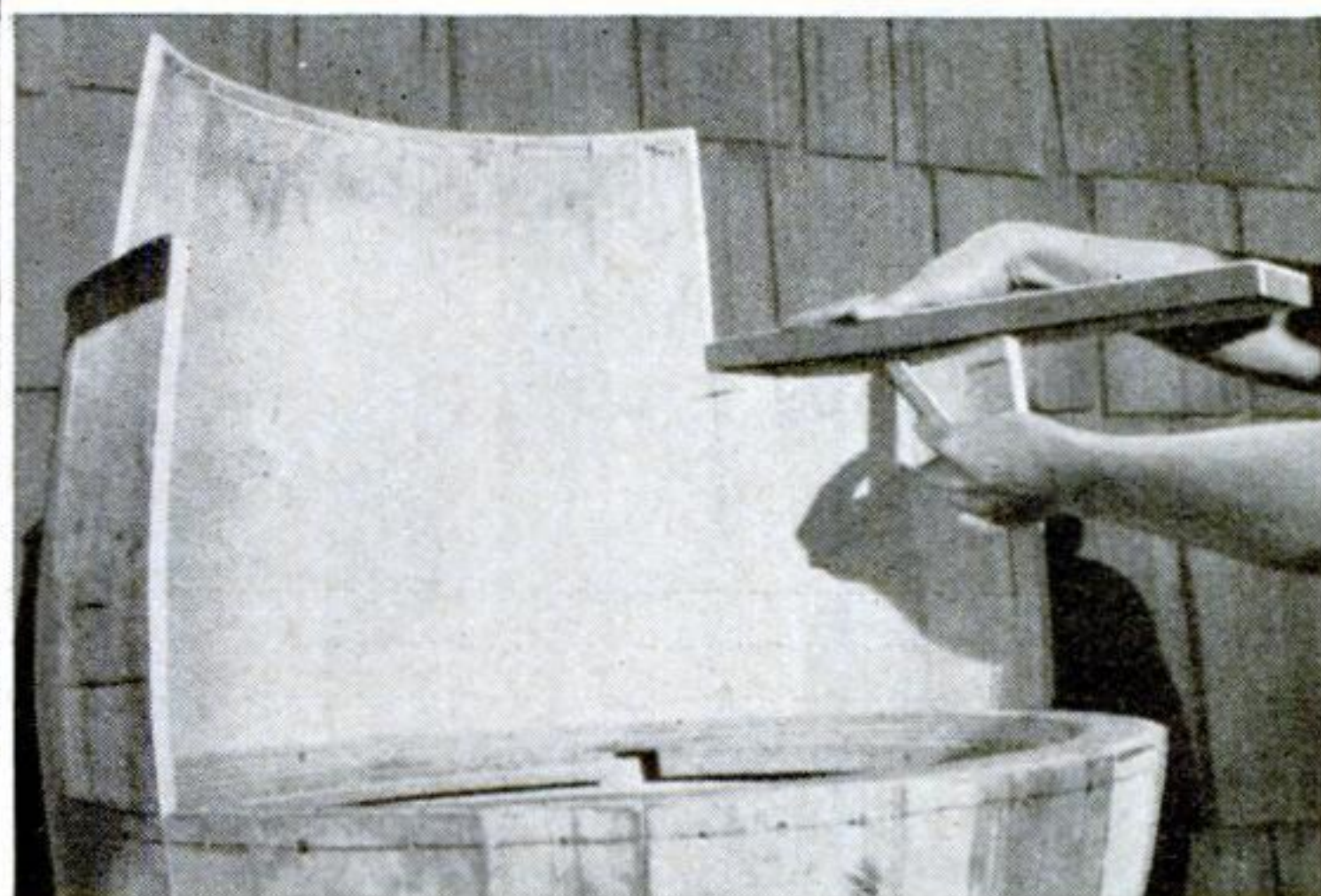


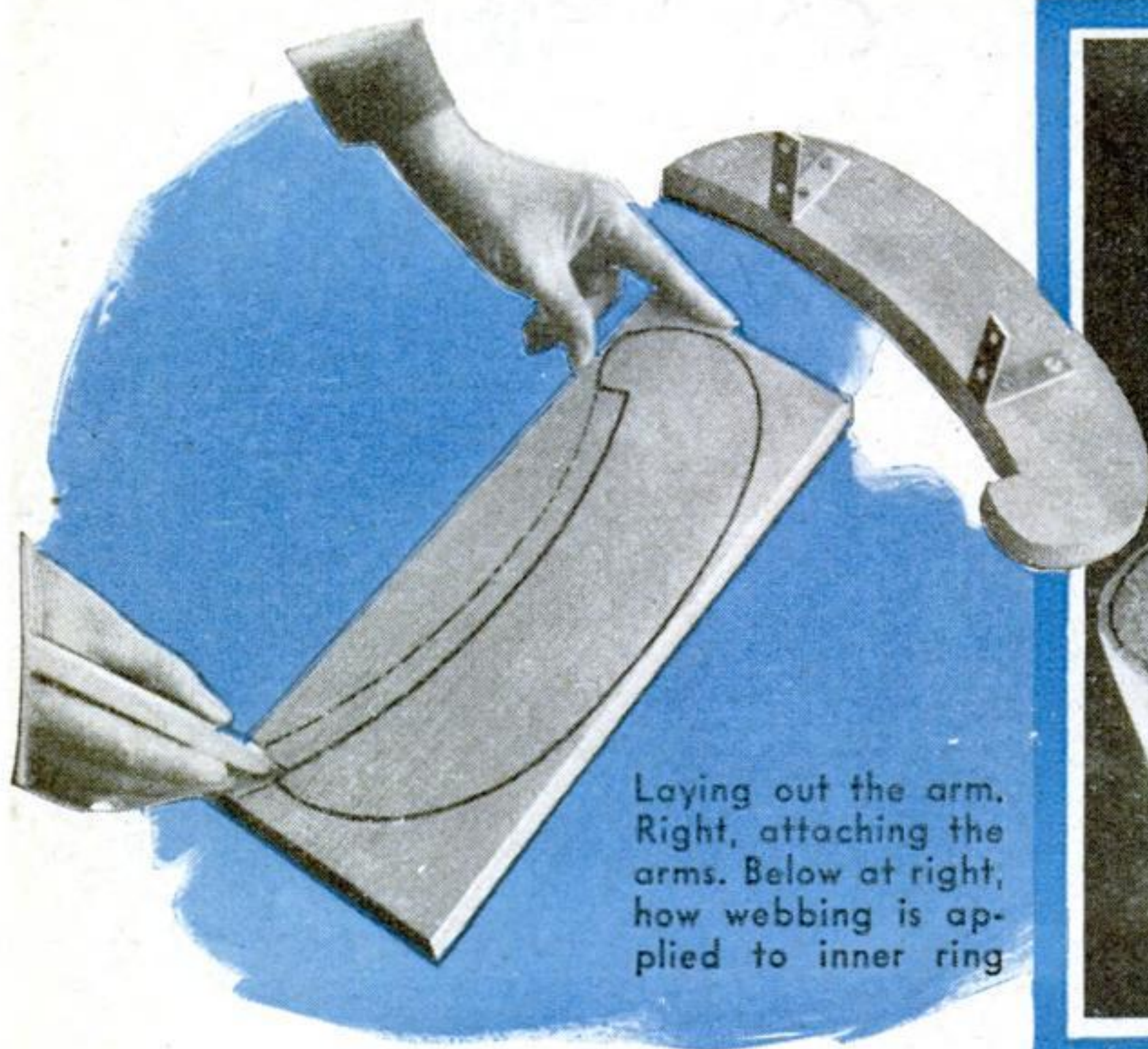
On the outer plywood seat ring it is necessary to screw four cleats so as to support the inner ring

Before drawing the shape of the arms, hold the wood as shown below and mark the curve of the barrel

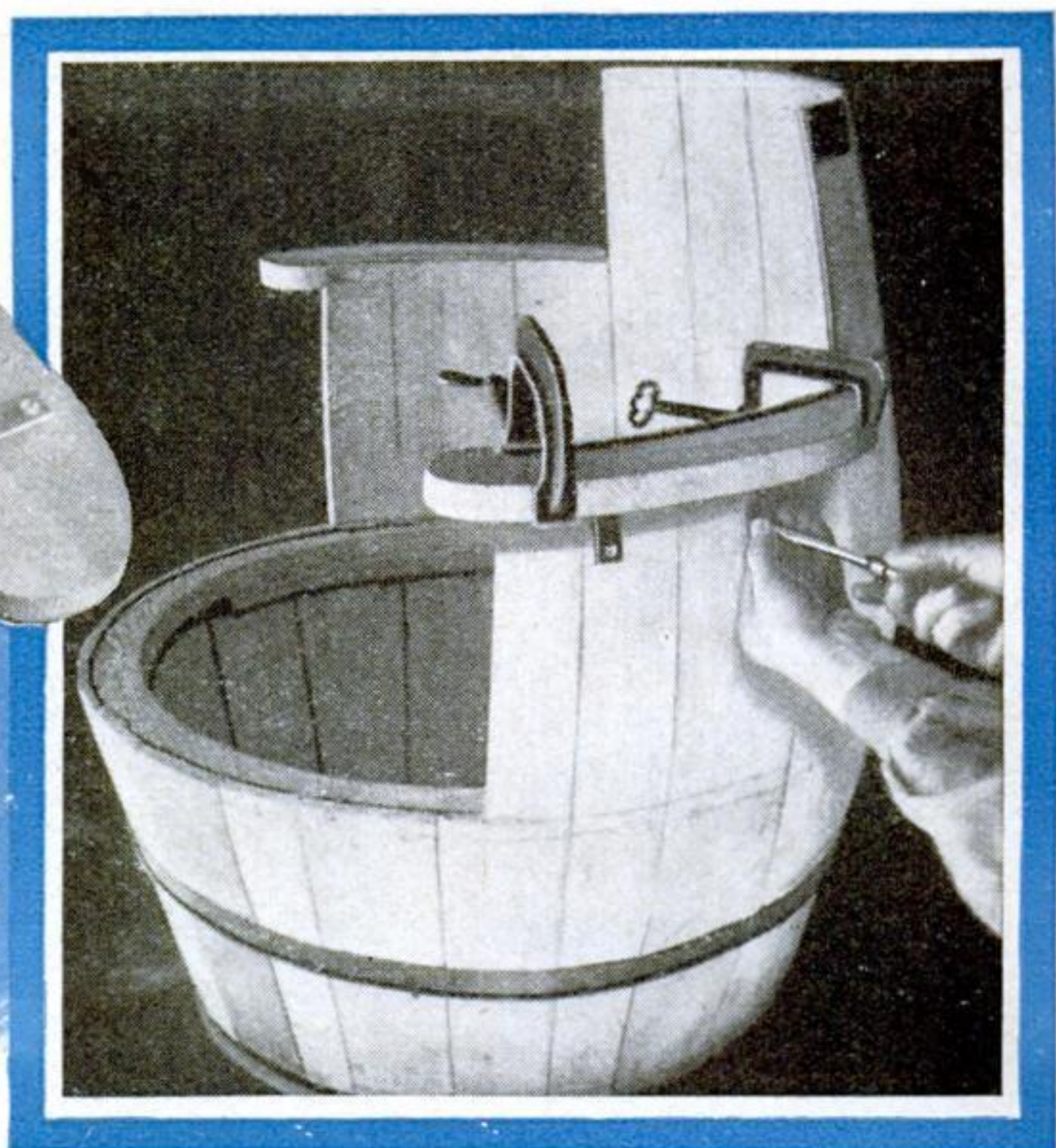


Screwing the outer ring in place. Note projecting cleats under the ring for holding the inner ring





Laying out the arm. Right, attaching the arms. Below at right, how webbing is applied to inner ring



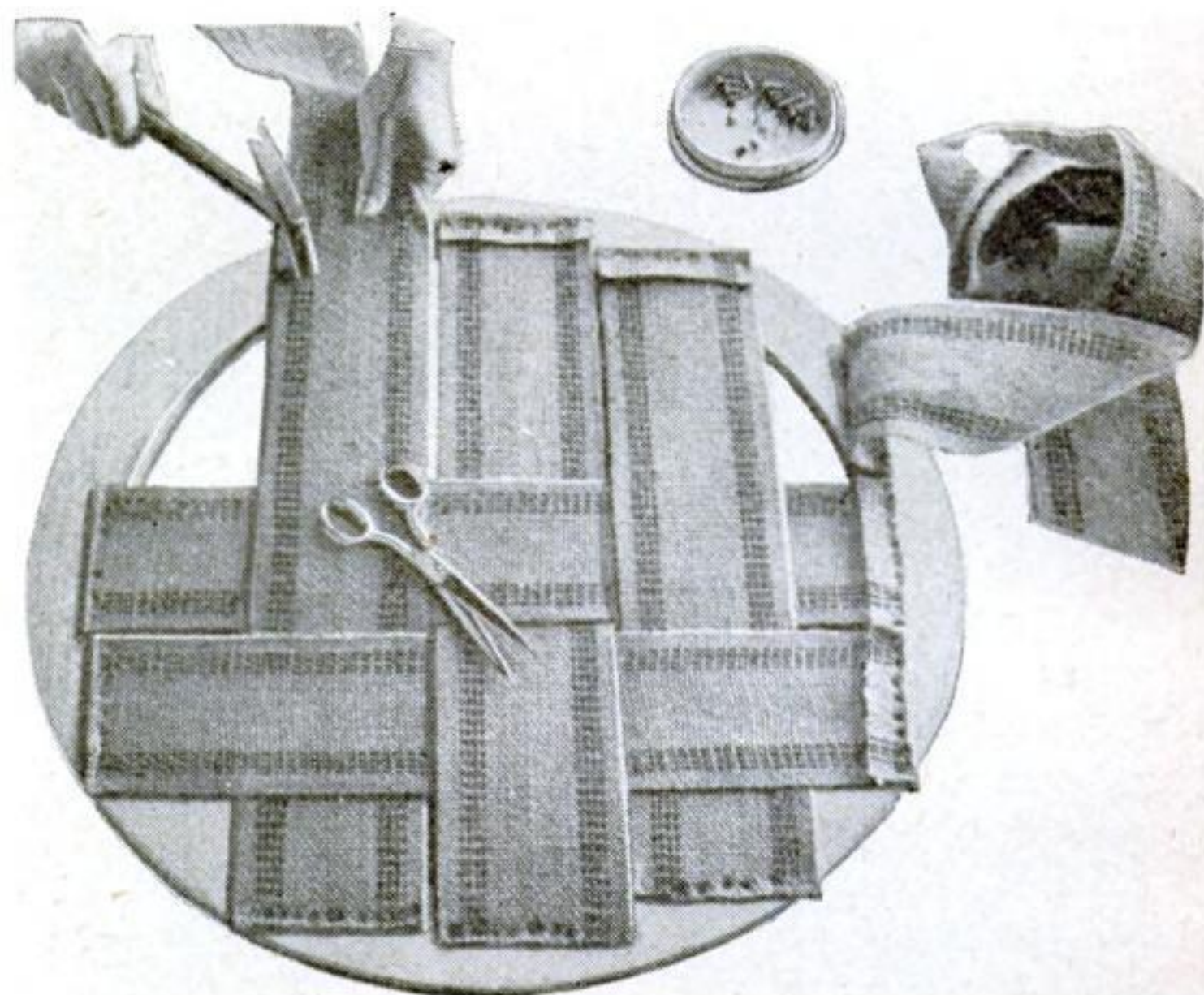
back of the barrel. At the widest part, near the front, the arm is $2\frac{1}{2}$ " across. Attach the arms as shown with 2" by 2" wrought-iron corner irons, fastened with 1" No. 8 wood screws. Saw or cut off the screw ends.

The final step in making the frame is to tack 4" upholsterer's webbing on the inside ring. Four yards of the webbing are required.

Next month—how to upholster the chair.

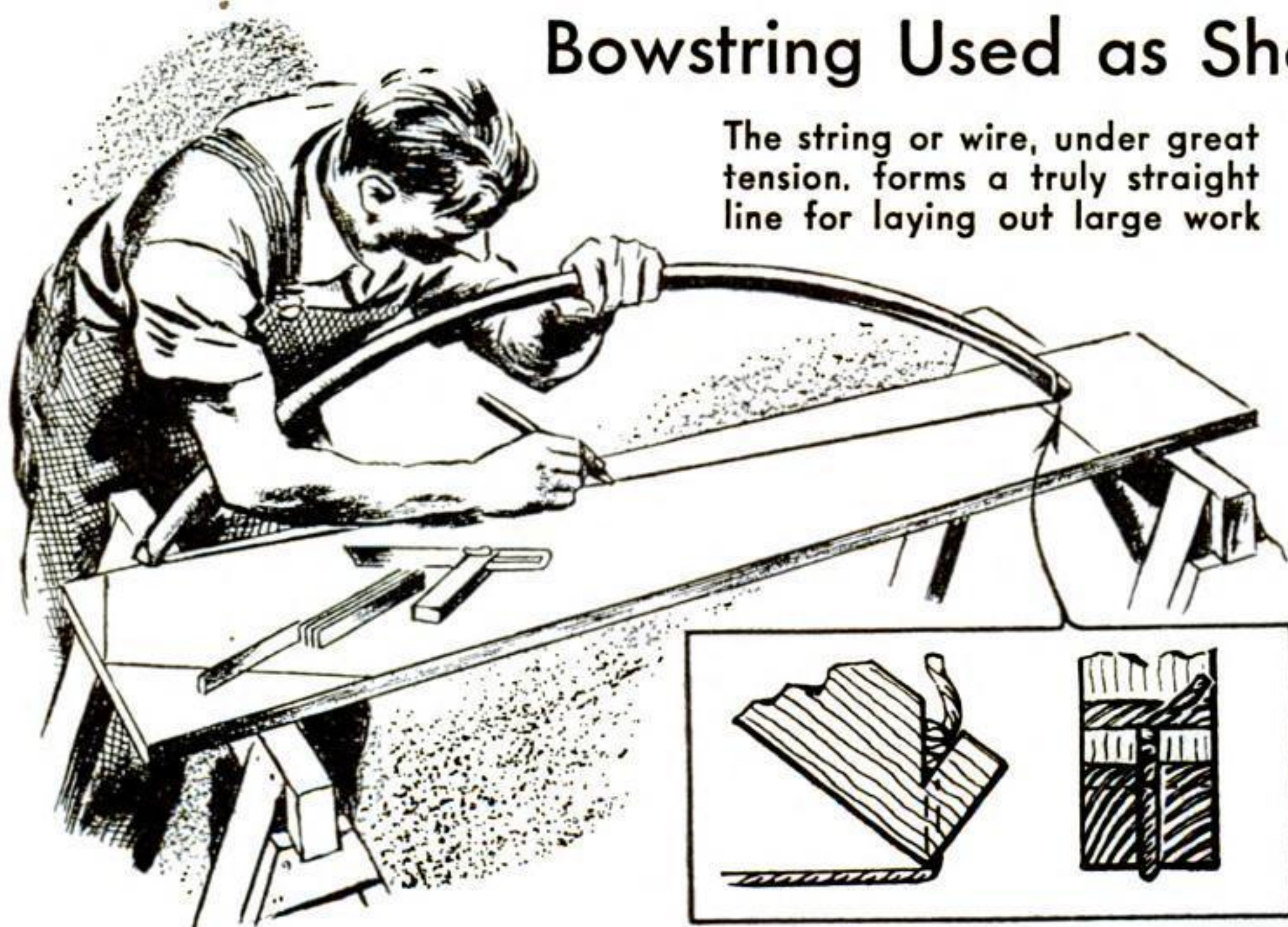
Cleaning a Paper Hanger's Brush

INSTEAD of washing out the bits of paste that stick to the bristles of a paper hanger's smooth-on brush, lay the brush on the edge of a table or box and comb the bristles with a wire brush.—L.O.

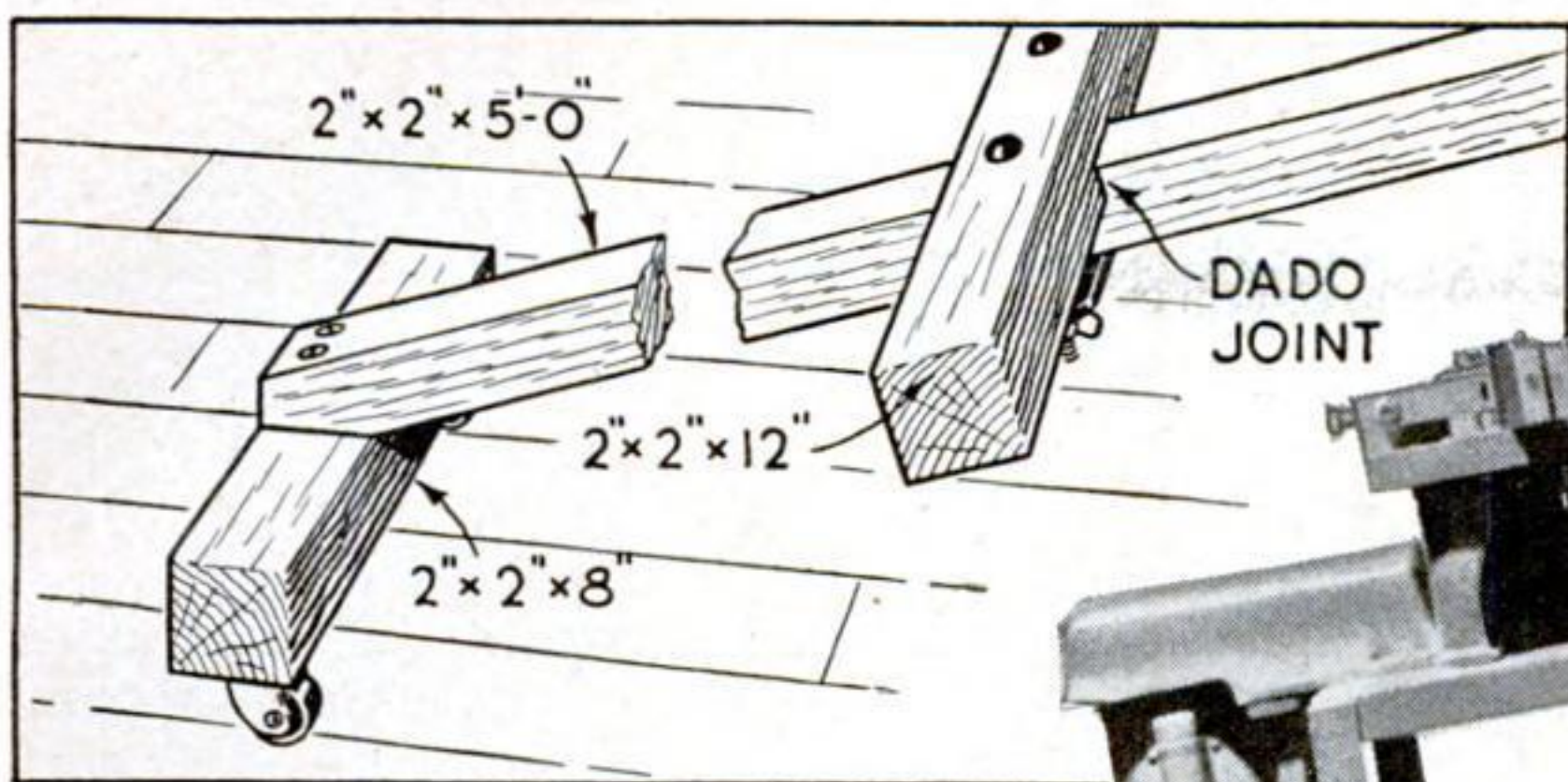


Bowstring Used as Shop Straightedge

The string or wire, under great tension, forms a truly straight line for laying out large work

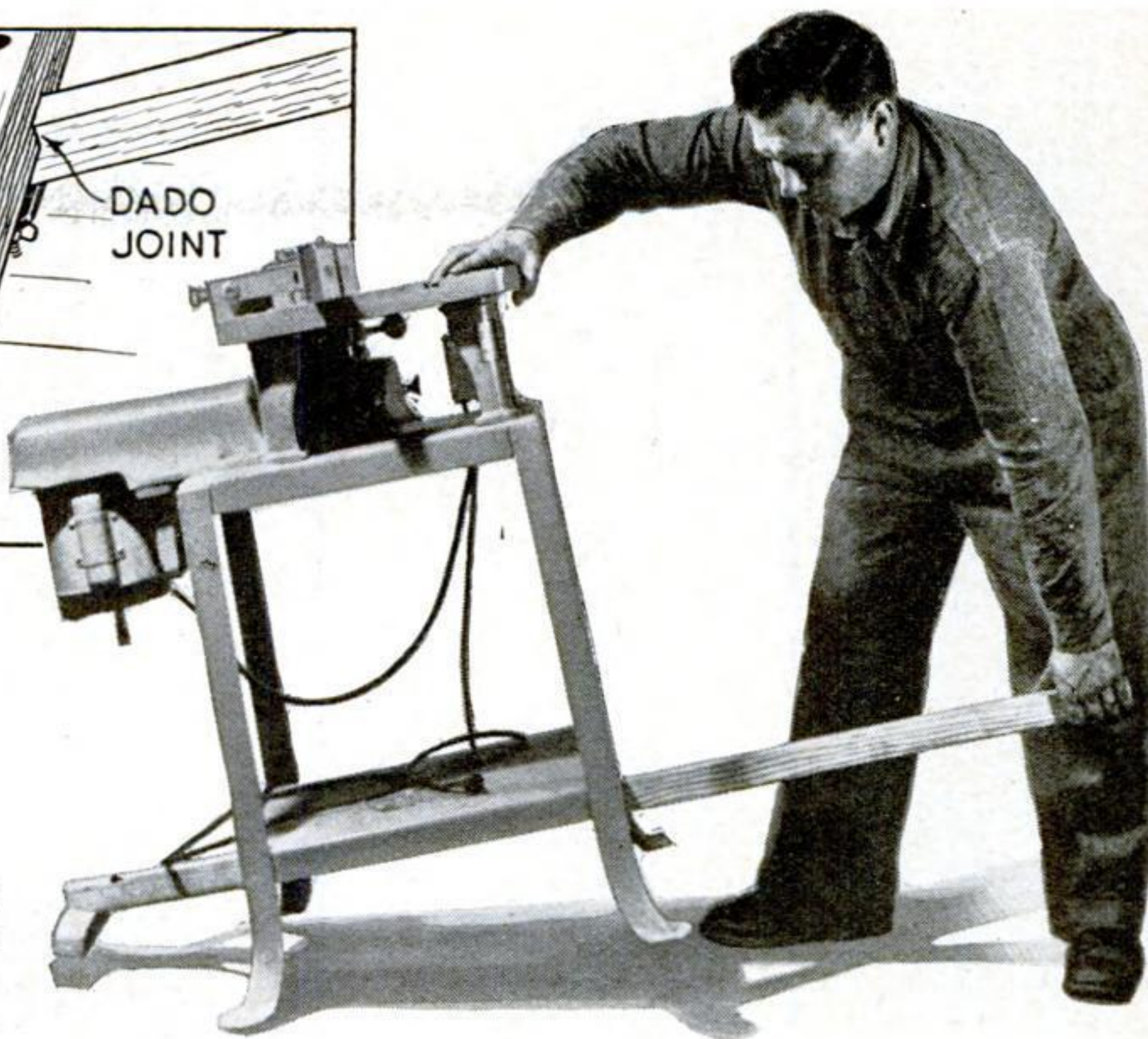


IN EVERY home workshop there is frequent need for a perfectly true straightedge. The ordinary wooden yardstick is good enough for rough work, but it is rarely free from some warpage or curvature, and it is often too short for the job in hand. I have solved this problem by making a long, stiff bow and using the string as a straight-edge. Either wood or steel may be used for the bow, and strong, thin cord or wire for the string. Notch the ends of the bow as illustrated at the left.—STEPHEN A. FRITSCH.



Dolly for Moving Small Power Tools Around Shop

HOME workshop power tools and other equipment can be moved around the shop more easily with a dolly of the type illustrated. If the machines are light, 2" by 2" wood is strong enough, but for heavy equipment use 2" by 4". The end of the main piece, which is 5' long, should be cut at an angle of about 18 deg. for the attachment of the 8" crosspiece. Another piece, 12" long, is fastened to

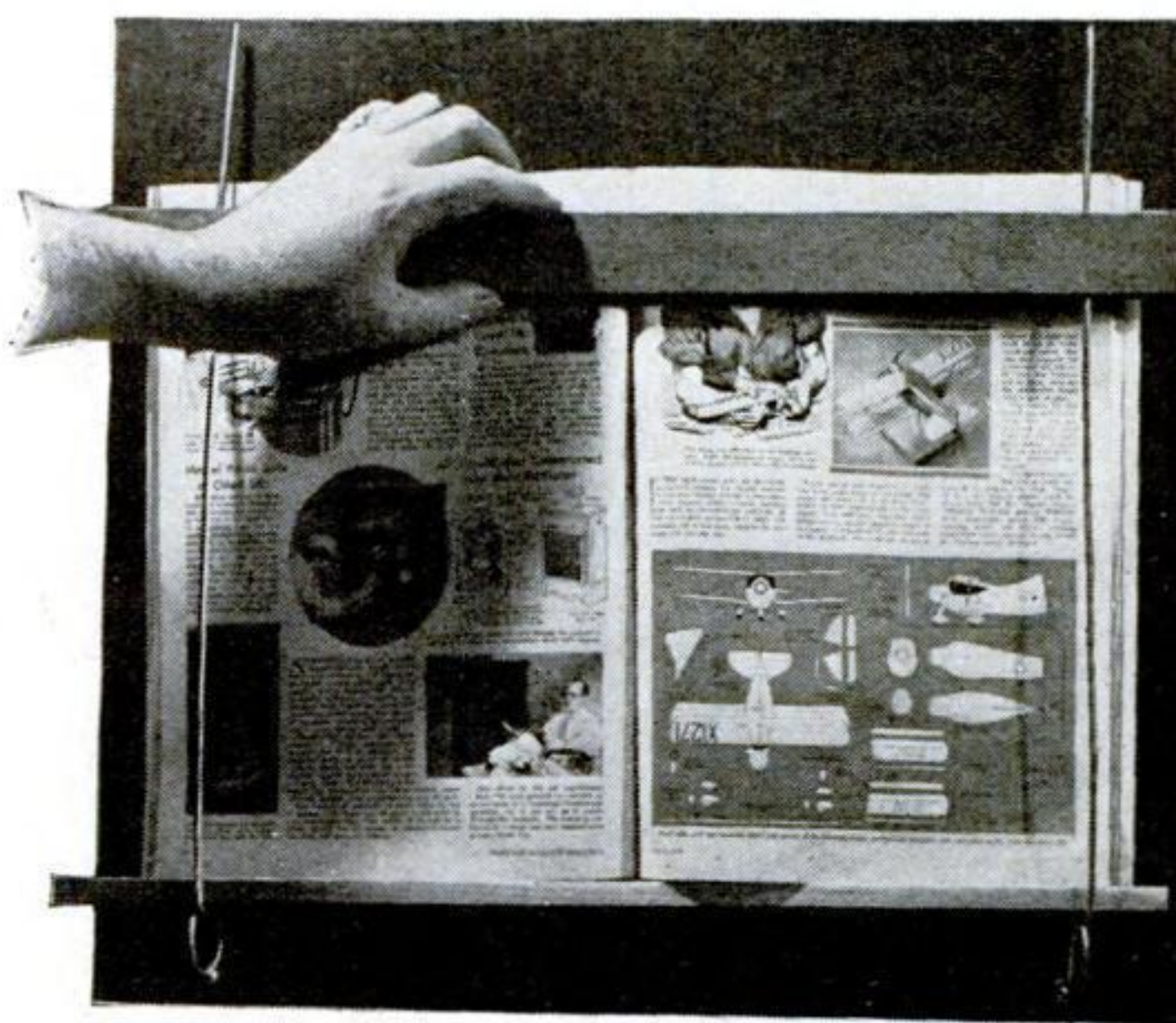


Using the dolly to shift the position of a small power tool. The upper crosspiece, shown in the sketch above, is adjustable

the handle in such a way that its position may be adjusted. Attach casters to the 8" crosspiece.—K. L. ROBBINS.

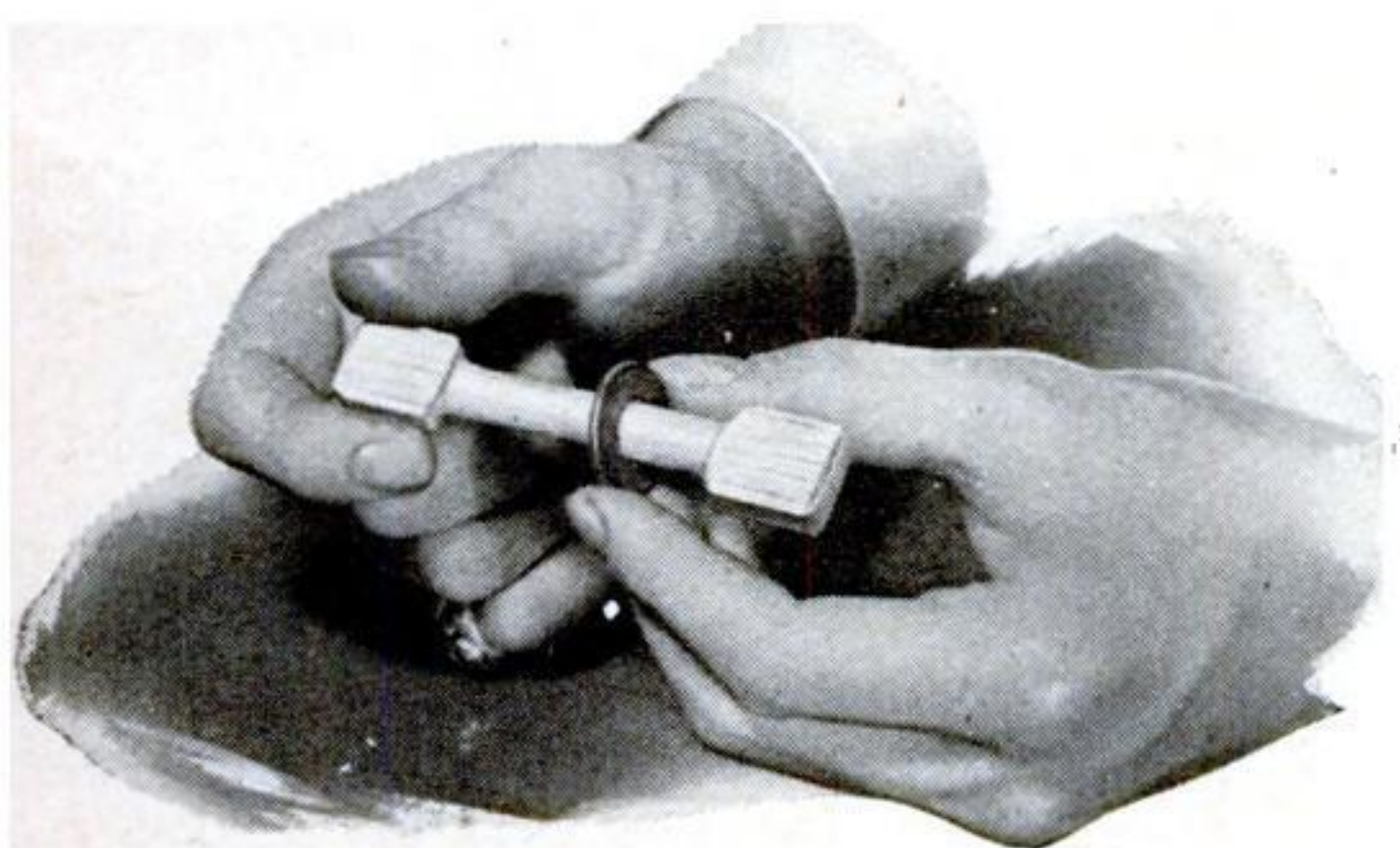
How Did the Iron Washer Get on This Stick?

YOUR friends will be mystified if you show them a small stick like the one below, which has a washer on it that obviously could not pass over the large ends. If the iron washer has a $\frac{3}{8}$ " hole, cut a thoroughly dry white pine stick $\frac{3}{8}$ " by $\frac{7}{8}$ " by 3" or 4" long. Leave each end full size and cut the center portion down until it is $\frac{3}{8}$ " round. Put one end in a vise, compress it from $\frac{7}{8}$ " down to $\frac{3}{8}$ ", remove it, and quickly drive it through the washer. Then dip the end in water. It will soon expand to practically its original size and shape. When dry, there is no indication of how it was done.—O. M. SOUTHWORTH.



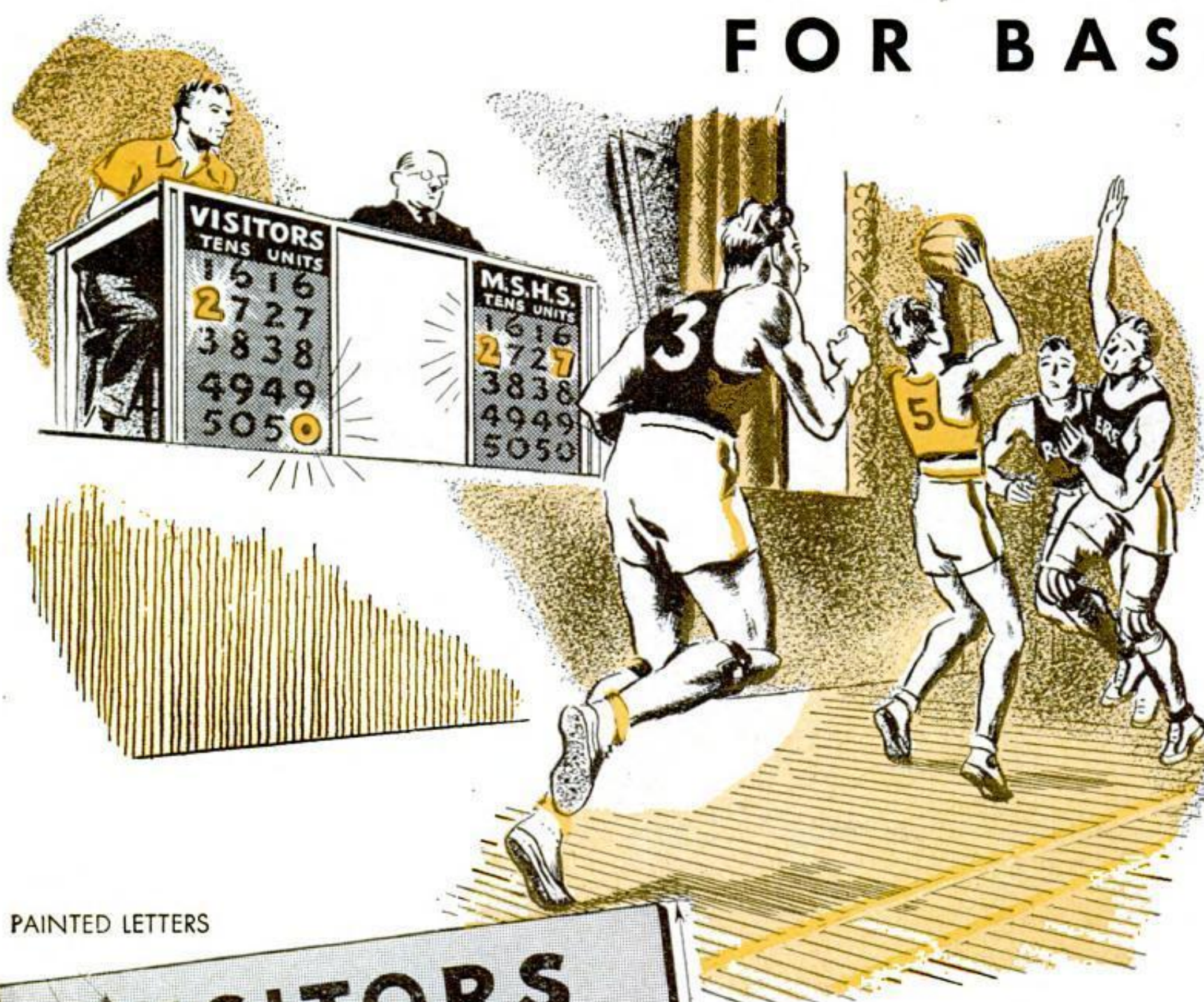
Easel for Holding Magazines with Old-Style Binding

WHEN working from old issues of POPULAR SCIENCE MONTHLY, which lacked the improved binding now being used, one workshop enthusiast sets the copy on a 16" by 18" easel of pressed composition wood with strap iron at the back to support it at a slight angle. Two steel wire springs carry a sliding strip as shown to keep the magazine flat and also serve as a marker.



Electric Score Board

FOR BASKETBALL

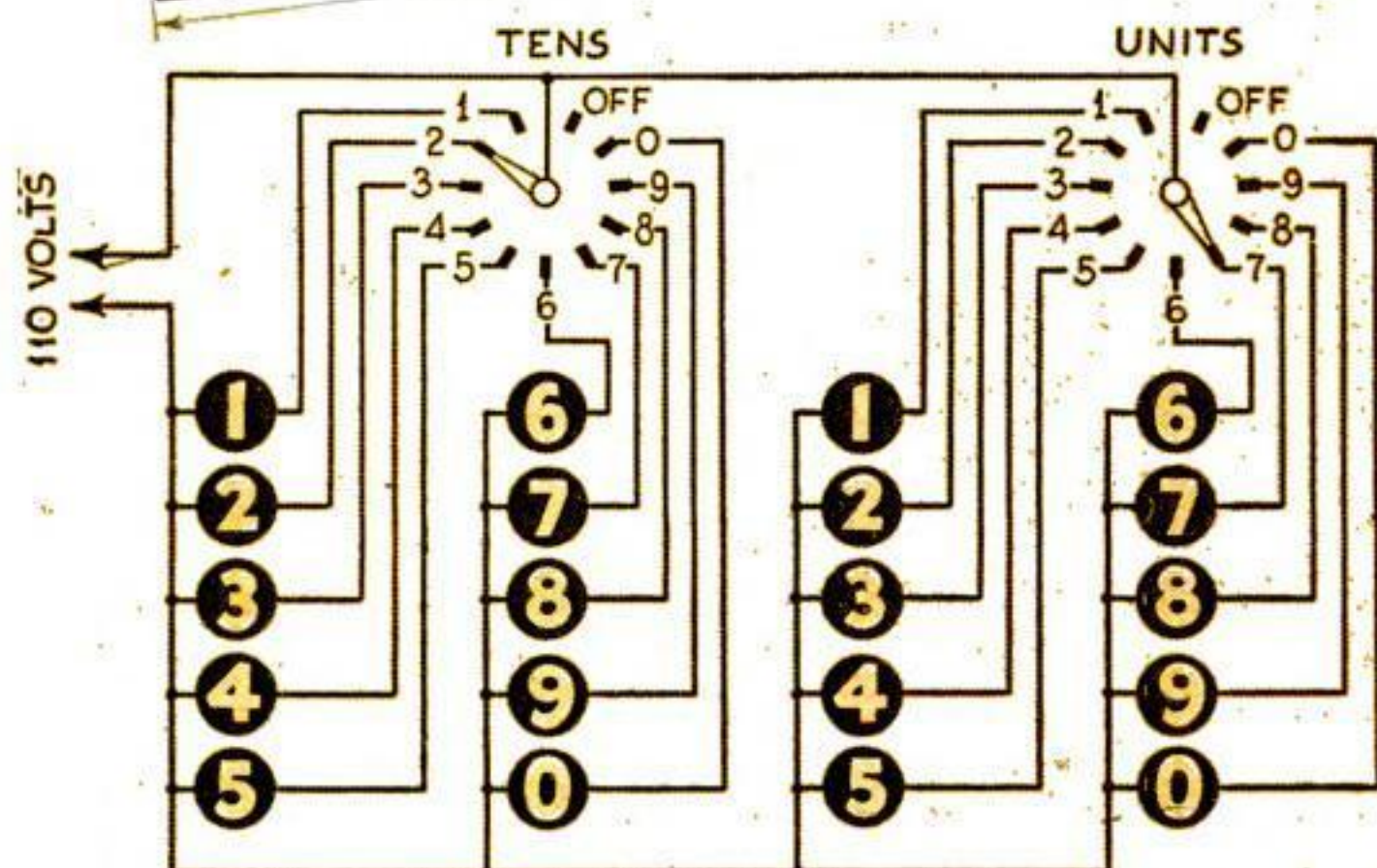
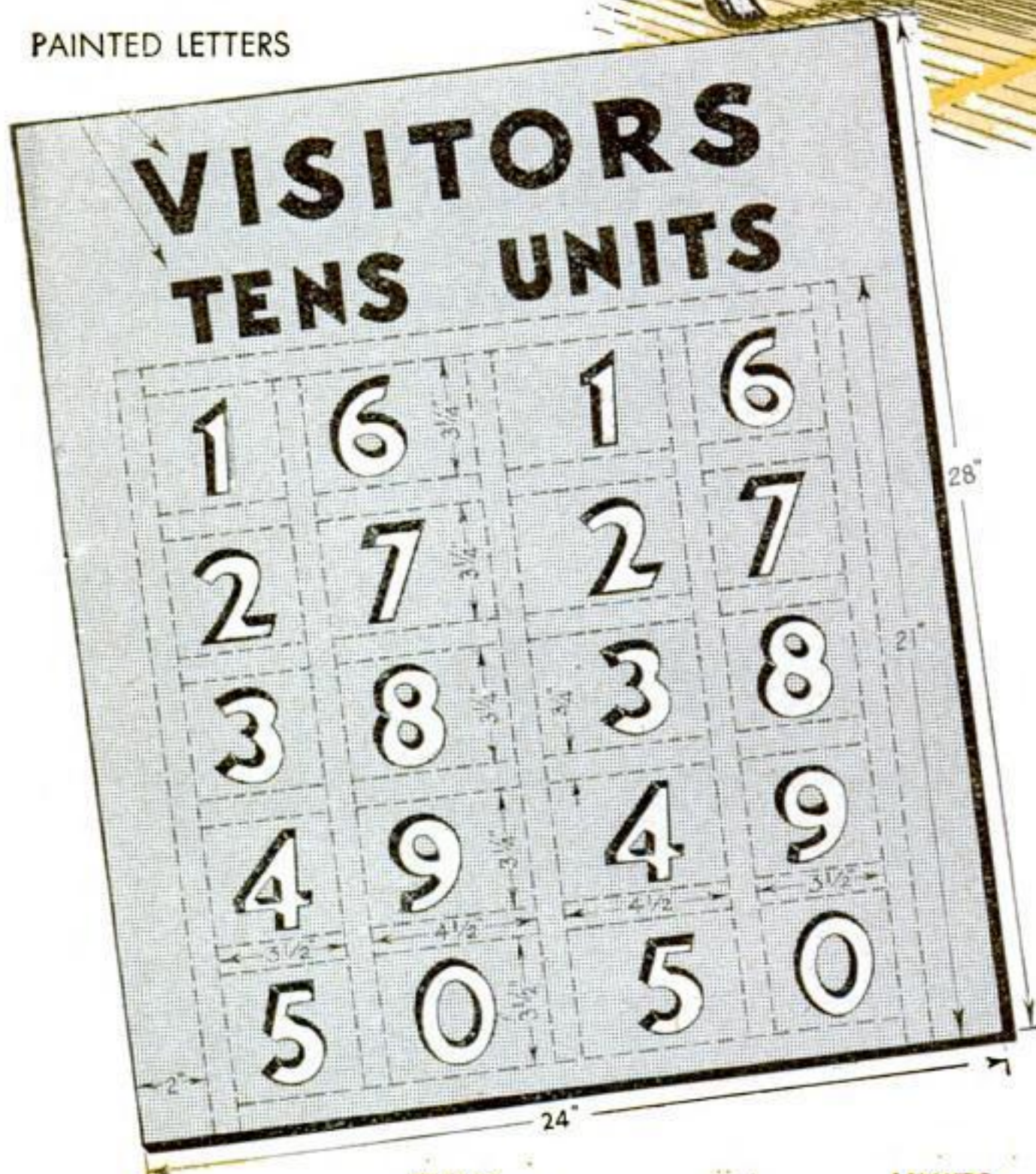


ELECTRIC basketball score boards are usually complicated and expensive, but this one is so simple that even a small school can afford to install it. There are two identical sections, one for the home team and the other for the visitors. Each section has two sets of ten numbers, running from one to zero. The first set represents the tens digit of the score; the second set, the units digit. Although this may appear a complicated method at first glance, no difficulty has been experienced in reading the board in actual use as the illuminated numbers

show up distinctly from every angle.

Twenty-five watt lamps are placed directly behind the numbers in compartments, as shown. The lights are controlled by switches on the timer's table. It is best to let the timer run the score board as usually he is not so busy as the official score keeper.

Cut two pieces of composition board 24" by



By WILLIAM A. HARRIMAN

List of Materials

Composition board, 4' by 4'
40' of $\frac{3}{4}$ " by 6" white pine boards
40 porcelain sockets and 25-watt lamps
200' insulated wire
4 radio switches, 11-point
3 yd. red cambric
80— $1\frac{1}{4}$ " stove bolts; wood screws, solder, etc.

Back of one of the twin units, showing the compartments and lamps. The sockets are bolted to the rear composition board



28" for the fronts, and two pieces 21" by 20" for the backs. Divide one front piece as shown and mark the numbers by tracing around 3" metal house numbers. Bolt the two front pieces together temporarily and jig-saw the numbers.

Build the lamp boxes from $\frac{3}{4}$ " by 6" pine and bolt the light sockets on the back piece of composition board. Wire each with a common ground. The other wire is brought through a hole in the back and left long enough to run to the switch.

Two layers of red cambric for diffusing the light are placed back of the cut-outs when the front piece is screwed to the boxes. The loose parts of the numbers, such as the centers of the O's, are cemented to the cloth. After placing the bulbs in their sockets, fasten on the back with wood screws. Solder the wires to the switches as indicated by the wiring diagram.

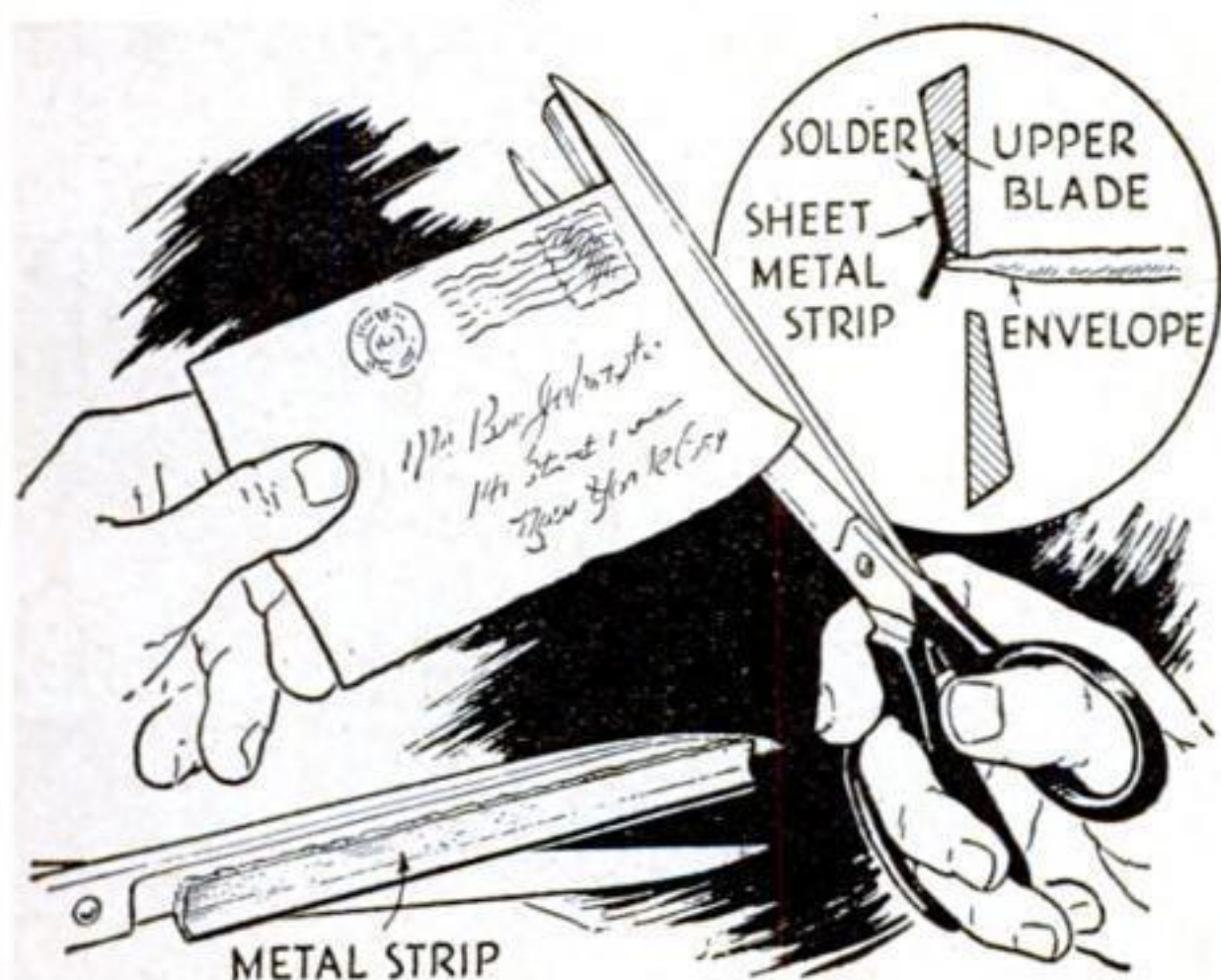
The sections are mounted together on the wall beside the timer or on the front of the officials' table. Bolt the switches in a convenient position on top of the table. Test them and indicate at each position the num-

ber which is illuminated by setting the switch at that point.

At the beginning of a game, all switches are set at "off" so all the lights are out. As scores are made, advance only the units digit switch, until ten is reached. Then advance the tens digit switch to one and begin over again with the units digit switch. Any score up to ninety-nine may be indicated on the board.

The score board is, of course, a temporary set-up for plugging into any convenient outlet, and it must be disconnected when not in use. If it is to be made a permanent installation, the wiring must be of a type to comply with the National Electrical Code and any local regulations, and it should then be inspected and approved.

Ordinary Shears Fitted with Stop for Opening Letters



ORDINARY shears may be converted into a letter opener that, considering its simplicity, will do work comparable in neatness with office letter-opening machines. A strip of brass or tin about $\frac{1}{2}$ " wide is soldered to the side of the upper blade as shown, leaving half the width of the strip extending below. The projecting part is then bent until parallel with the travel of the cutting edges. The end of the letter is held squarely under the upper blade and against the strip, so that the lower blade will shear off a narrow strip from the end of the envelope without cutting the letter or any literature which may be inclosed.—GEORGE F. READ.



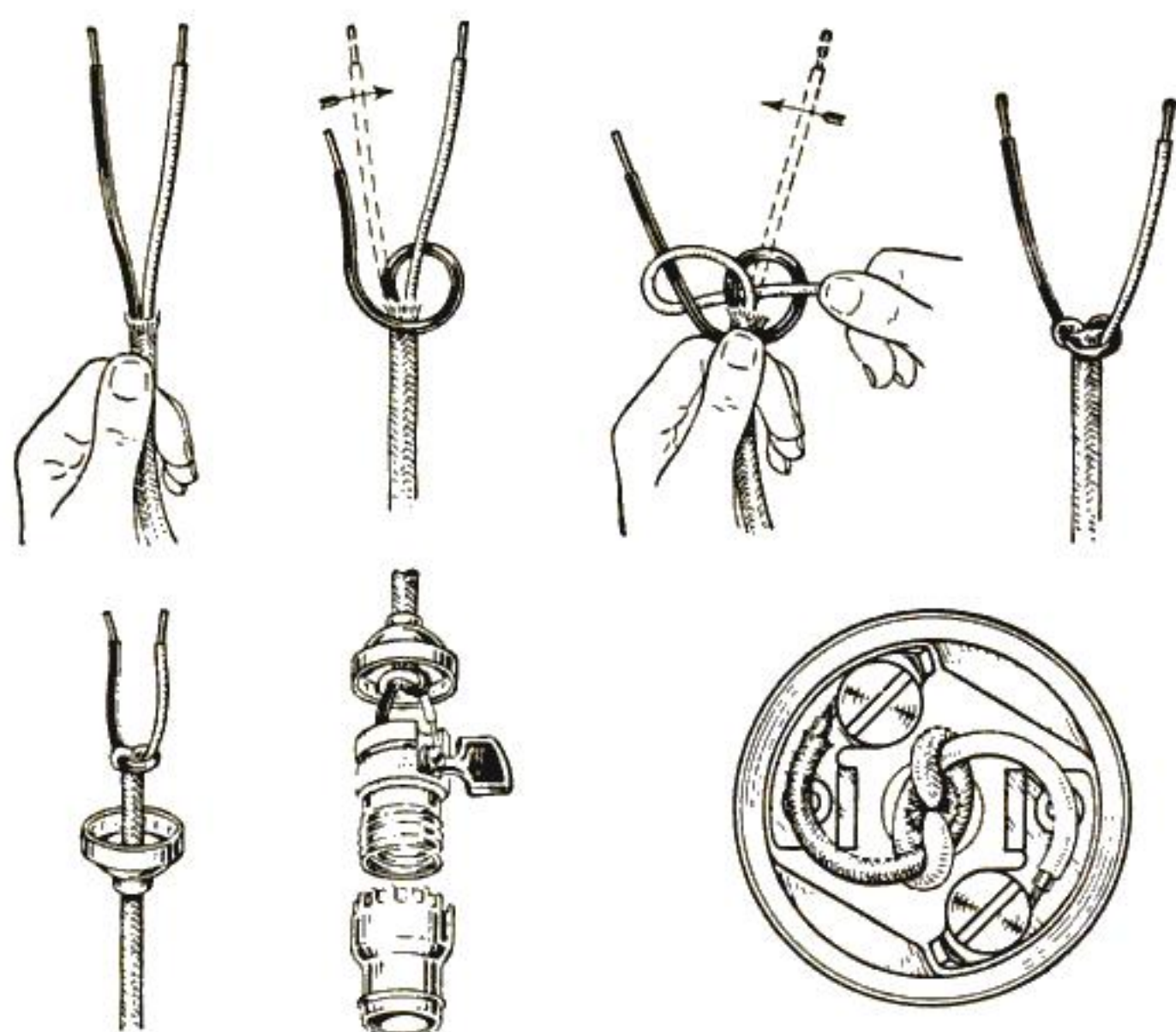
WORKSHOP

A New Service

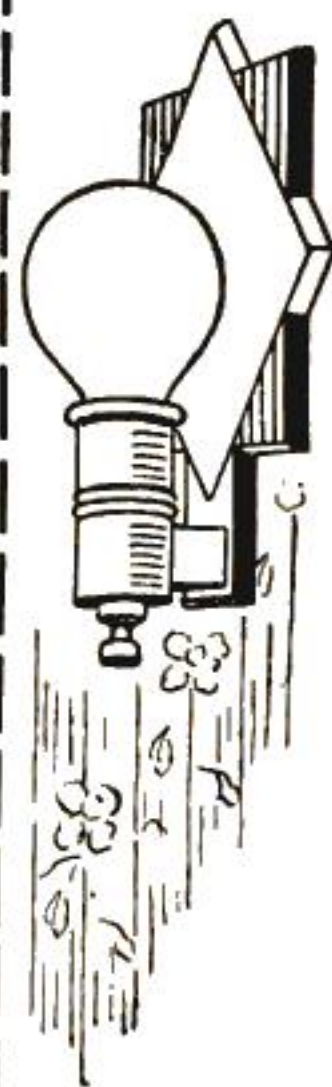
giving information and formulas to help you meet your day-by-day problems

UNDERWRITERS' KNOT

[ELECTRICAL]



WHEN attaching electric cords to sockets, plugs, and similar devices, use the underwriters' knot as shown. Keep the loops of knot well down on the outer braid so the latter will be tightly clamped to prevent fraying. Untwist or split the end; bring one wire back of the other in a loop; hold it in place; with the other hand take the second wire around the first and pull it up from the back through the loop.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

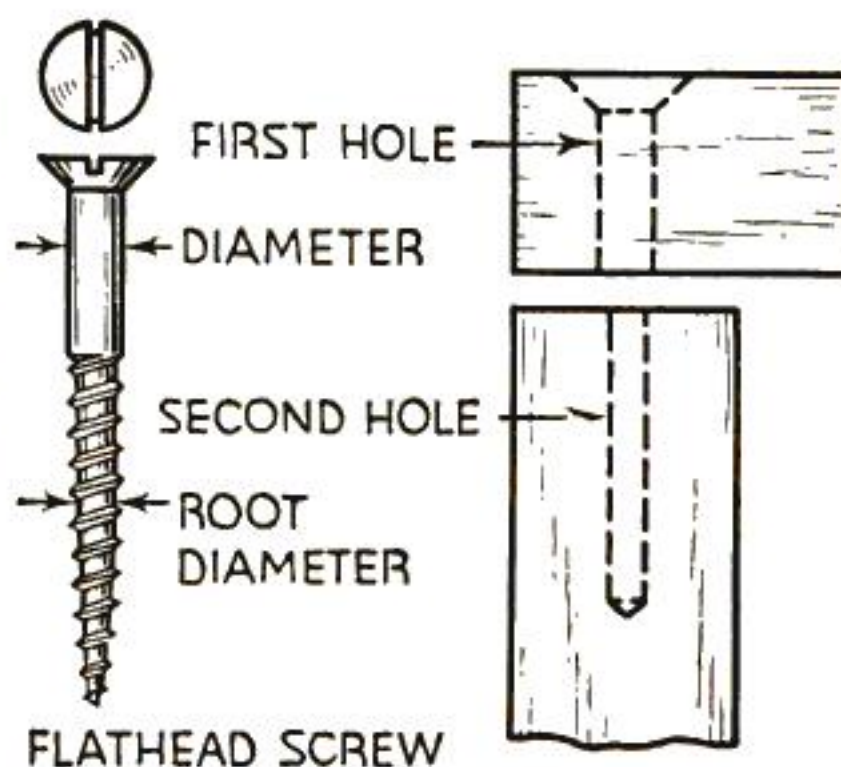
WOOD SCREWS

[HARDWARE]

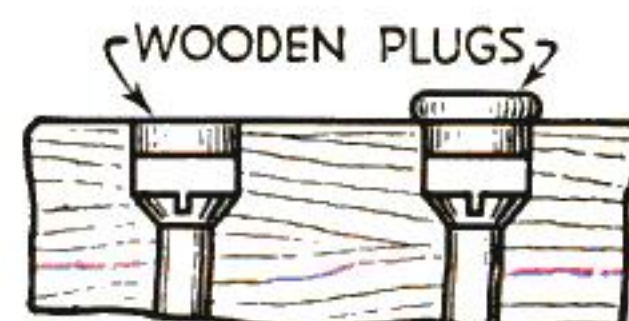


DIAMETERS of screws for wood are indicated by numbers. When fastening two pieces of wood together, a hole of a diameter equal to that of the screw must be bored in the first piece so that the screw enters without friction. Counter-sink the hole if a flathead screw is used. The heads may be hidden, if desired, with wooden plugs as shown. Bore a hole equal to the root diameter of the screw in the second piece of wood. For use in hardwood, first rub the screw threads on a piece of soap.

Gauge No. of screw	Dia. of first hole	Dia. of second hole
6	$\frac{5}{32}$ "	$\frac{1}{8}$ "
7	$\frac{5}{32}$ "	$\frac{1}{8}$ "
8	$\frac{3}{16}$ "	$\frac{5}{32}$ "
9	$\frac{3}{16}$ "	$\frac{5}{32}$ "
10	$\frac{7}{32}$ "	$\frac{5}{32}$ "
11	$\frac{7}{32}$ "	$\frac{3}{16}$ "
12	$\frac{1}{4}$ "	$\frac{3}{16}$ "



FLATHEAD SCREW



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DATA IN TABLOID FORM.

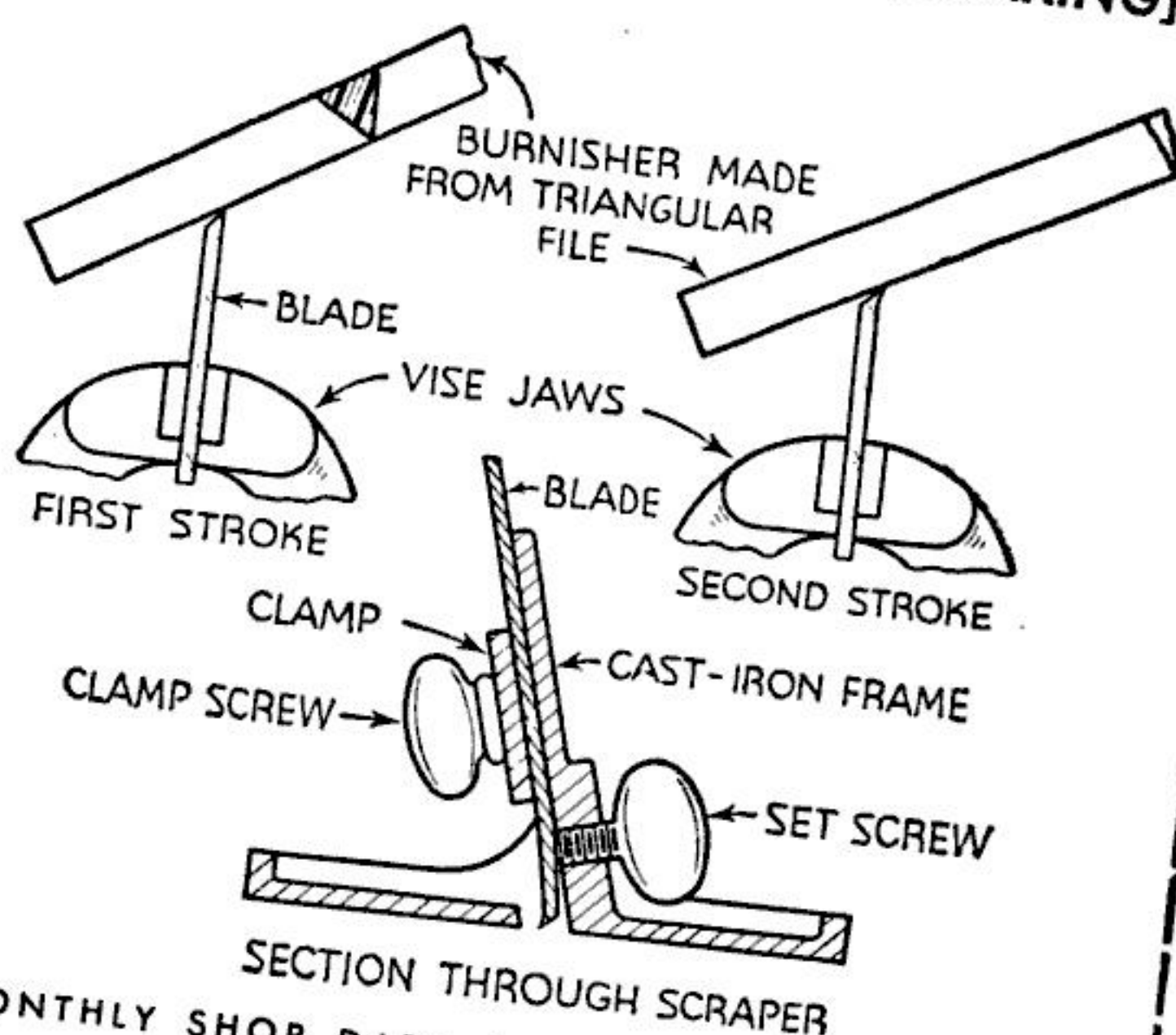
FOR twenty years the Home Workshop Department of POPULAR SCIENCE MONTHLY has been accumulating carefully tabulated and illustrated information on the methods, problems, operations, and formulas required in everyday shopwork and in making repairs about the house. Now for the first time this

invaluable shop data is made available to you in a handy, tabloid form. Each topic is arranged as though it were a 3" by 5" file card in order to distinguish it from other material and make it available for ready reference (see also pages 168 and 169). This service will appear each month.

SHARPENING CABINET SCRAPERS

[WOODWORKING]

GRIND and whet blade exactly as a plane iron. Test edge for straightness with a try-square. Clamp blade in bench vise and bend its edge with two strokes of a burnisher. Hold burnisher at an angle, never horizontal. Insert blade in cabinet scraper frame from below. Turn set screw back, place scraper on a flat wood surface, and tighten both clamp screws. Turn set screw until it bears against blade, then give it a quarter turn. To use file as a burnisher, grind off the teeth and polish well.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

TACK RAG

[PAINTING]

IN varnishing and enameling furniture and other woodwork, it is vitally important to keep the surface clean just ahead of the brush. A practical means of doing this is to use a so-called "tack rag." This may be purchased or made. Preparation: Use lintless cloth such as an old handkerchief, which is good because of its hemmed edges. Dip it in water, wring quite dry, then sprinkle lightly with varnish. Refold and rewring so the varnish permeates the cloth. Keep it rolled in oilcloth or waxed paper when not in use to prevent drying out. Should this occur, sprinkle with water and wring out again.



POPULAR SCIENCE MONTHLY SHOP DATA FILE



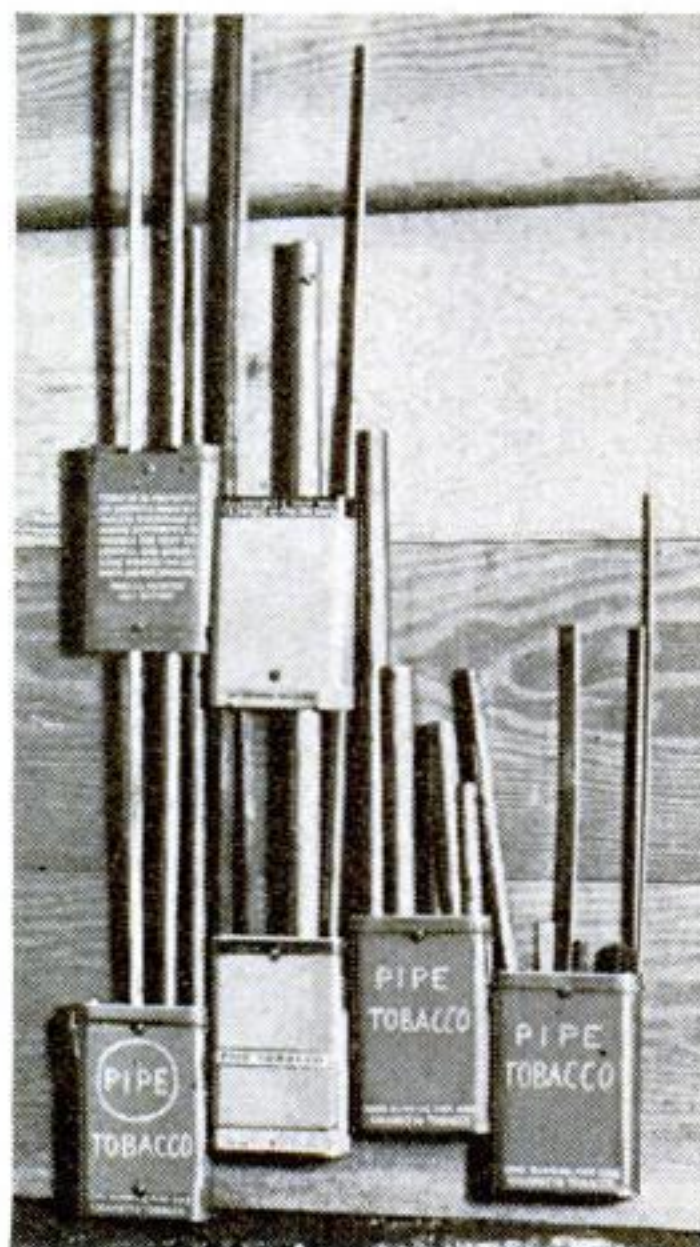
Two bolts clamp the saw handle between the pole and a short piece of wood. Tape is inserted so as to prevent any slipping

Handsaw Handle Extended for Trimming Trees

TO TRIM branches of a tree that could not otherwise be reached, an extension of $\frac{7}{8}$ " by $1\frac{1}{2}$ " wood can be bolted on a saw as shown. To prevent scratching the saw handle and lessen the likelihood that the saw will slip, friction tape may be placed between the handle and the two pieces of wood. The length of the pole is optional. The two bolts should be $\frac{1}{4}$ " in diameter and 3" long.—C. A. VEBURG.

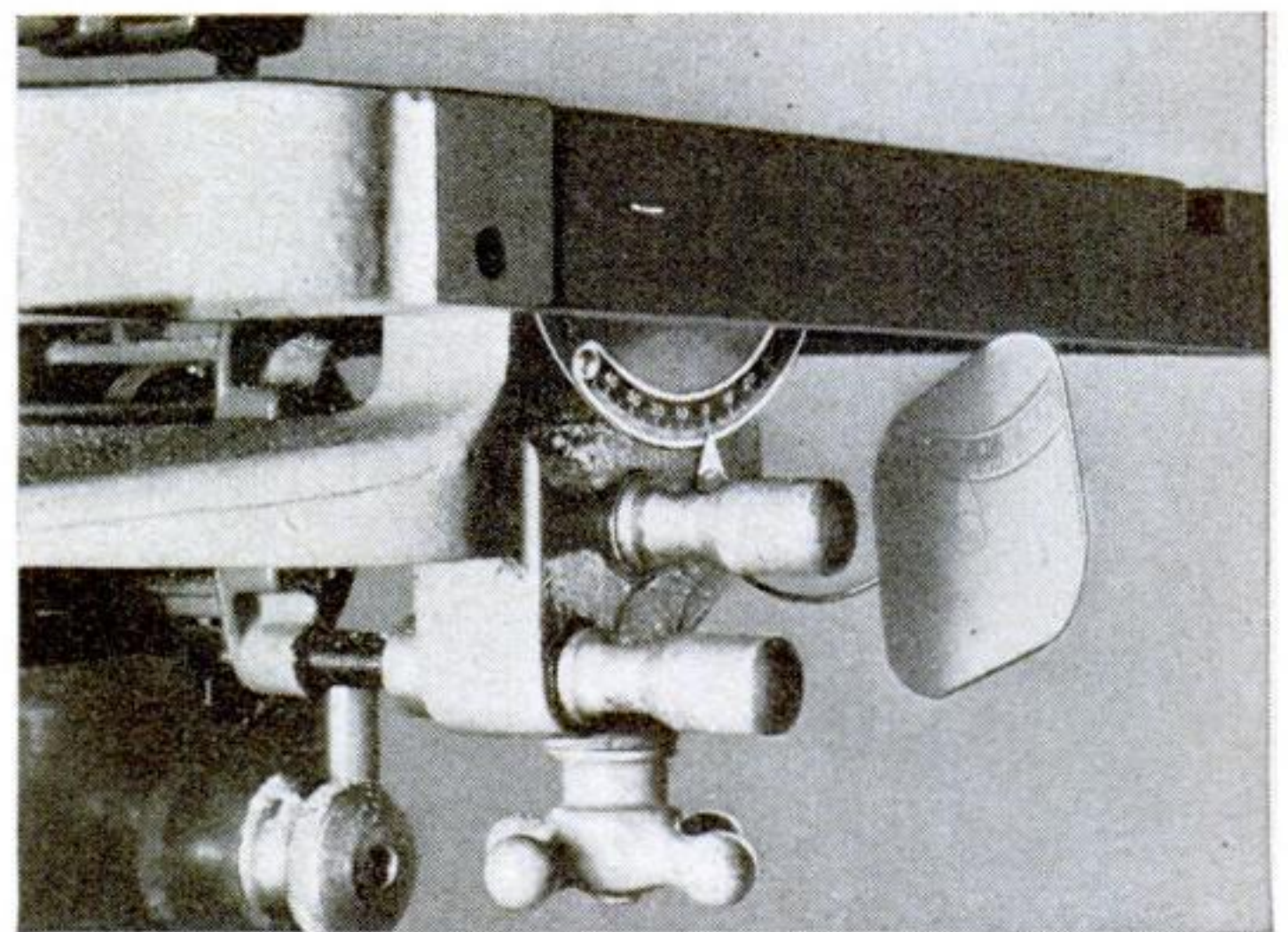
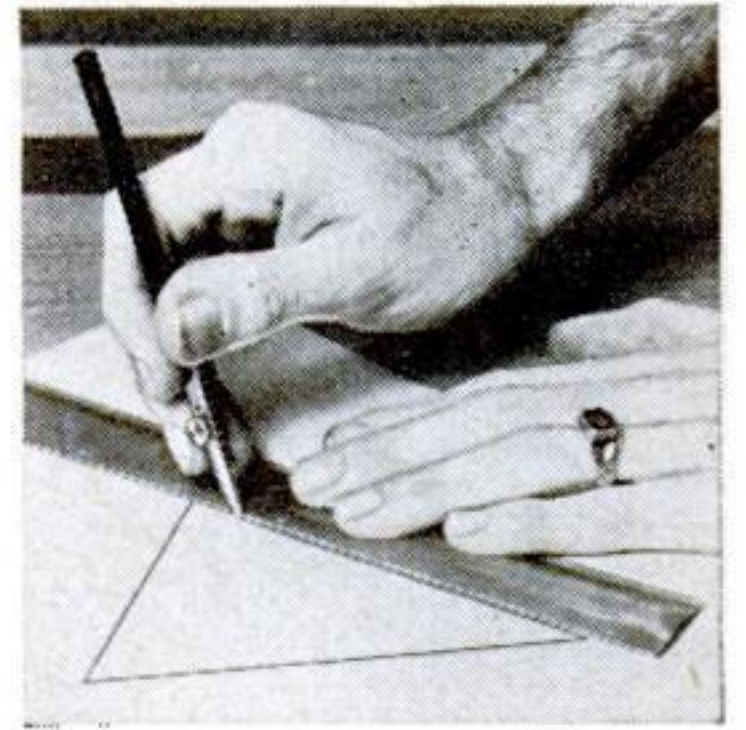
Small Tobacco Cans Hold Rods

FLAT, pocket-size tobacco cans, if nailed to the shop wall, make convenient holders for rods, tubes, and strips of wood or metal. For the longer strips, extra cans with the bottoms removed may be nailed a foot or more above the lower cans, as illustrated. You may find it more convenient to build a separate wall panel on which to fasten the cans.



Brass Weather Strip Used as Shop Straightedge

FOR shop use or even at the drawing board, a good straightedge can be made from a section of spring-brass weather strip of the type illustrated. Since the strip is slightly curved along the center and has both edges turned a little, a ruling pen may be drawn along it without danger of smearing. Unlike a wooden rule, it is not likely to become nicked.—JOHN C. WORKLEY.

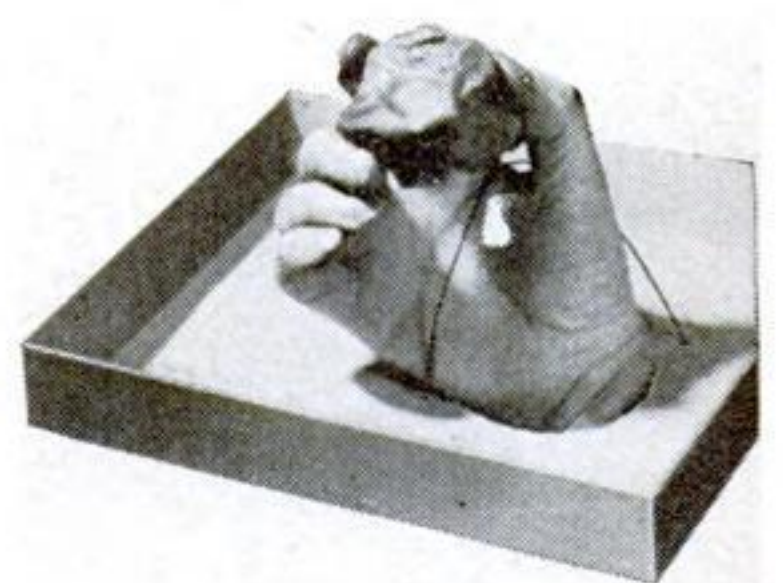


Tin Reflector Illuminates Scale on Power Tool

A SMALL square of bright tin or other metal attached to a power tool as shown will reflect light on a tilt or cutting-depth scale located under the table where illumination is poor. It is then much easier to read the scale with accuracy.

Box Aids in Cleaning a Ceiling

WHEN wall paper on a ceiling has to be renovated with wall-paper cleaner, the crumbs can be caught by using a deep cardboard box lid as shown. A hole is cut in the center to admit the hand and wrist, and the ends of a short piece of cord are anchored near the opening so that the loop may be slipped over the thumb to prevent tilting or slipping down the arm.





Official Magazine
POPULAR SCIENCE
MONTHLY

The Guild Offers Free Manual

A Manual for Home Workshop Clubs

NATIONAL HOMEWORKSHOP GUILD
347 FOURTH AVENUE, NEW YORK

HERE ARE THE CONTENTS

1. Building up the Membership of a Club
2. How to Arrange Entertaining Programs
3. Holding Successful Craftwork Exhibitions
4. The Secret of Obtaining Good Publicity
5. How to Get Speakers and Demonstrators
6. Establishing a Home Workshop Library
7. Hints on Taking Home Workshop Pictures

YOU can now start a home workshop club with absolute confidence of building it into a successful organization because the National Homeworkshop Guild has just published a manual that contains everything you need to know. A copy is given free to each new club.

Crammed within its nine closely printed pages are a multitude of ideas and suggestions: hints on arranging programs, obtaining good publicity, taking home workshop pictures, building up a library, holding club exhibitions, and enlarging the membership. Actually, the manual consists of seven bul-

letins on different subjects. The Guild plans to reprint these and other bulletins in booklet form later and will then have to charge for each copy, but for a limited period you can obtain one without cost as soon as your club is chartered.

This is one of the most helpful of the many services the Guild has undertaken and will go a long way toward assisting your group to get firmly established. Once you have digested and put into practice the information in the manual, your club should grow steadily and soon become an integral part of the community.

In order to help in the preliminary work of organizing local clubs, the Guild has another instruction bulletin that tells exactly how to get started and contains a model constitution and by-laws. It will be sent free, together with an application blank for a charter, upon receipt of a large (legal size), stamped, addressed envelope. The Guild is a noncommercial and nonprofit unit for the promotion of the home workshop hobby, and it charges no dues or fees of any kind. For full information fill out the coupon or write a letter at once. Applicants must be at least sixteen years of age.

National Homeworkshop Guild 347 Fourth Avenue, New York

Yes, I want to start a home workshop club. Please send me complete information, including an application blank for a free charter in the National Homeworkshop Guild. Reserve a copy of "A Manual for Home Workshop Clubs," which is to be mailed when the club is chartered. I understand that this will not obligate me in any way.

NAME.....

ADDRESS.....

CITY.....STATE.....



Clubs Start Christmas

NOW that the hot weather is about over, home workshop clubs through the United States and Canada are rapidly resuming activities. For the most part, the members are concentrating on Christmas projects, although exhibitions, membership drives, local contests, demonstrations, and special features are also planned.

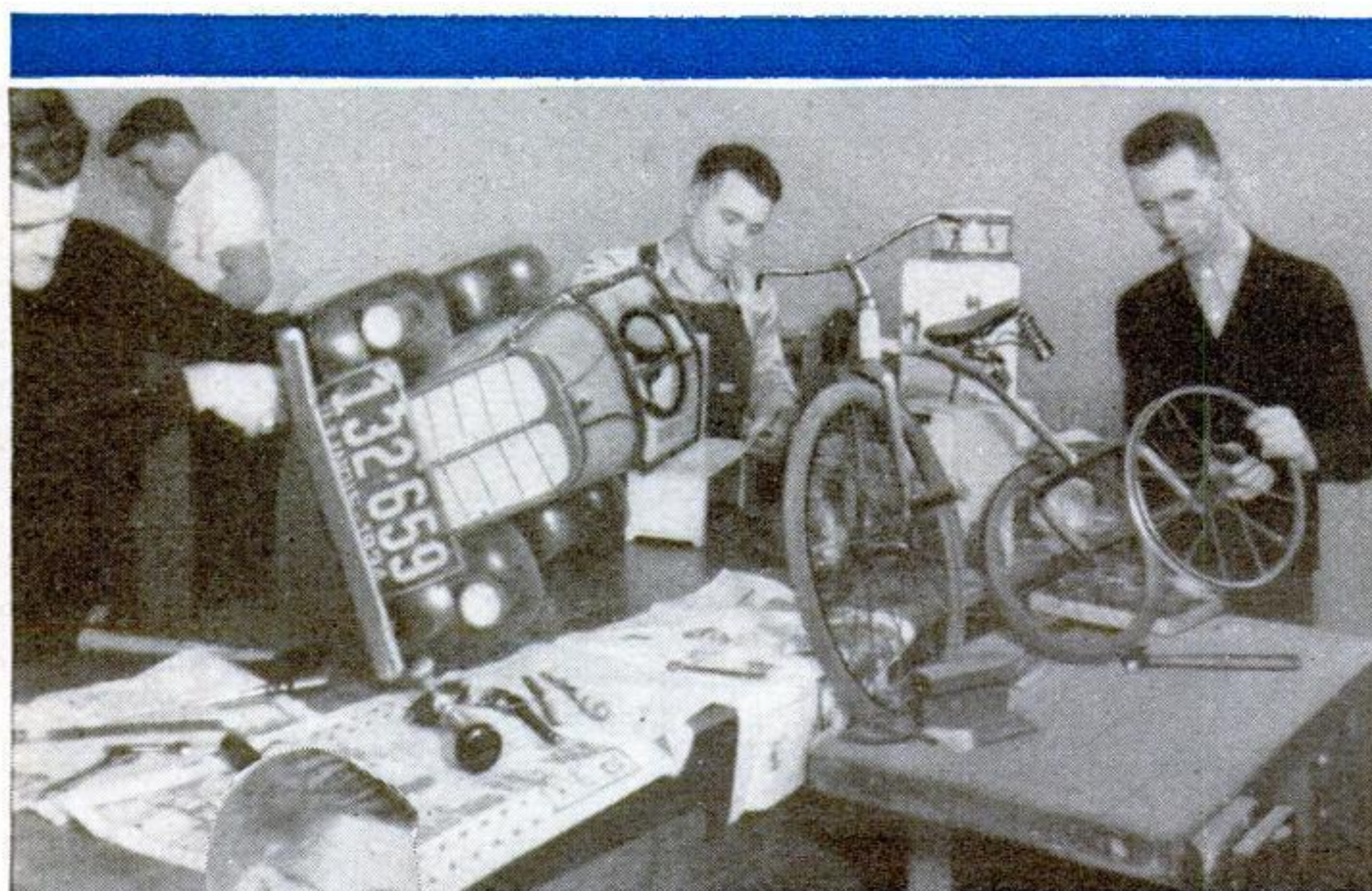
Many of the clubs make and repair toys all the year around, but there is always increased enterprise in the fall. Pictured on this page are members of the Staley Handi-

craft Club of *Decatur, Ill.*, with some of the hundreds of damaged toys they expect to put in first-class condition before Christmas. John Anderson is directing the work. Paul Simroth, Ted Shondel, and Keith Talbott act as instructors and show the other members, when necessary, how to make the repairs.

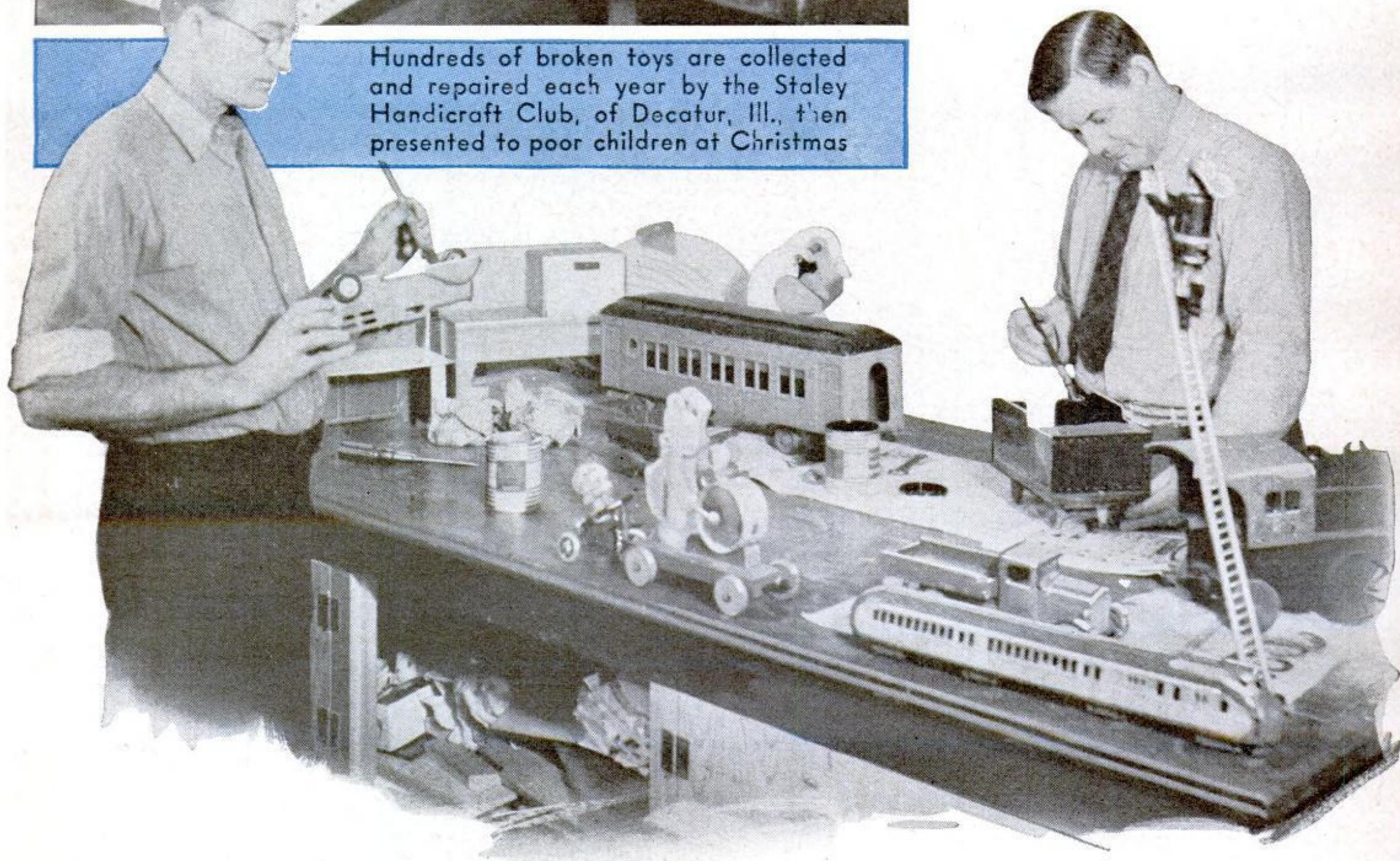
The Homecraftsman's Club of *Long Beach, Calif.*, has the most elaborate toy program of all clubs in the National Homeworkshop Guild. Last year the ninety-six members made 5,000 toys for distribution through a local newspaper's "Cheer Fund," and this

year they hope to accomplish even more. There were 500 doll beds, 1,000 sewing ducks, 2,000 animal wheel toys, 1,000 toy boats, 200 games, 50 hand-carved character dolls, 50 doll buggies, and 200 miscellaneous toys. The club has been doing this work for six years.

Earl Sanderson has been placed in charge of the model division of the Bison Builders' Guild, *Buffalo, N. Y.* Some of the members spent the summer remodeling old furniture into modernistic pieces. Melvin Baer donated several new books to the club



Hundreds of broken toys are collected and repaired each year by the Staley Handicraft Club, of Decatur, Ill., then presented to poor children at Christmas



Projects as Season Opens



Members of the Timber Craft Homeworkshop Club, New Bedford, Mass. Note the sailboat whatnot shelves; they were designed by Charles Jeglinski, president

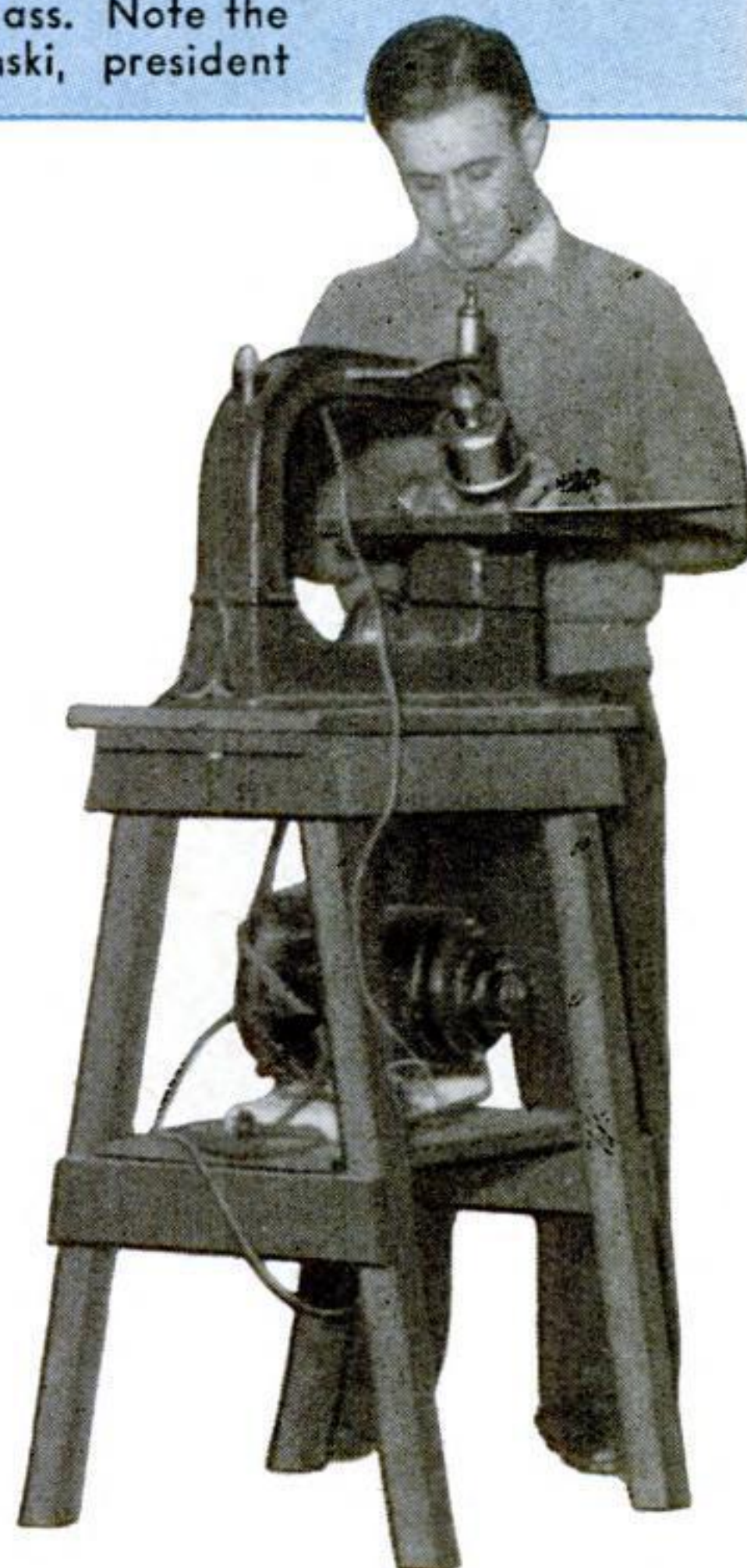
library, which now has more than 600 volumes. A picnic will be held in October at the Canadian lodge of George Harris.

New officers of the *Findlay (Ohio)* Homecraft Club are Owen Firestone, president; A. G. Briggs, vice president; R. O. Koehler, secretary-treasurer, and E. C. Bartlett, librarian . . . Henry J. Jung was in charge of the outing of the Hardwood Homeworkshop Club, *Neenah, Wisc.*, held at Washington Park, Milwaukee . . . Several picnics were held during the summer by the *Lincoln (Nebr.)* Homeworkshop Club. Meetings will be resumed in September under the supervision of A. C. Easton. The members have been invited to send in suggestions for projects to be undertaken . . . At one of the first meetings of the *South Denver (Colo.)*

Homeworkshop Club, the members were required to whittle out gavels. The best one was presented to the president . . . The *Racine (Wisc.)* Homeworkshop Club met recently at the workshop of John Nelson and enjoyed an illustrated colored-slide lecture on bees and beekeeping. Mr. Nelson exhibited a glass hive he had made.

A central meeting room has been obtained by the Emmanuel Hand Craft Guild, *New York, N. Y.* It is equipped with workbenches, tables, cabinets, and hand tools. The members are interested in model making, painting, artwork, and woodworking.

The *Regina (Sask., Canada)* Homeworkshop Club displayed craftwork at the Regina Provincial Exhibition.



Walter Modesto, secretary of the Timber Craft Club, at his jig saw

Graceful Inlaid Table Lamp Made from Seven Different Woods

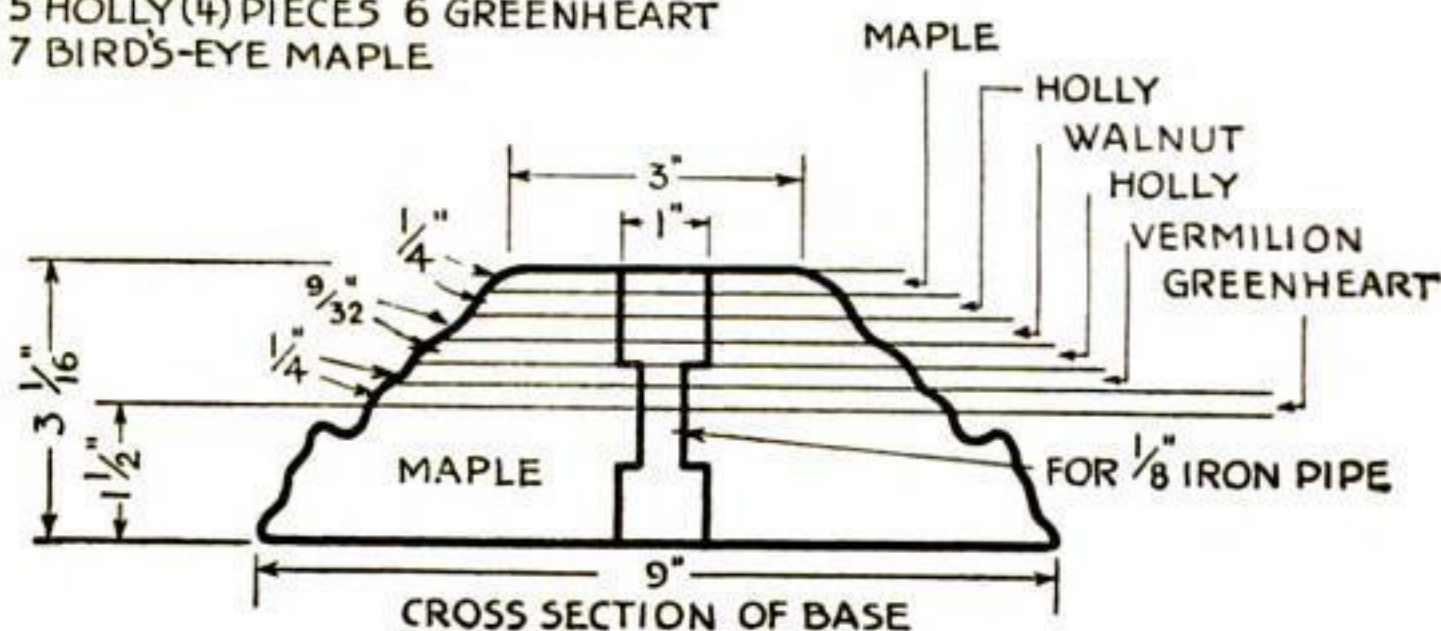
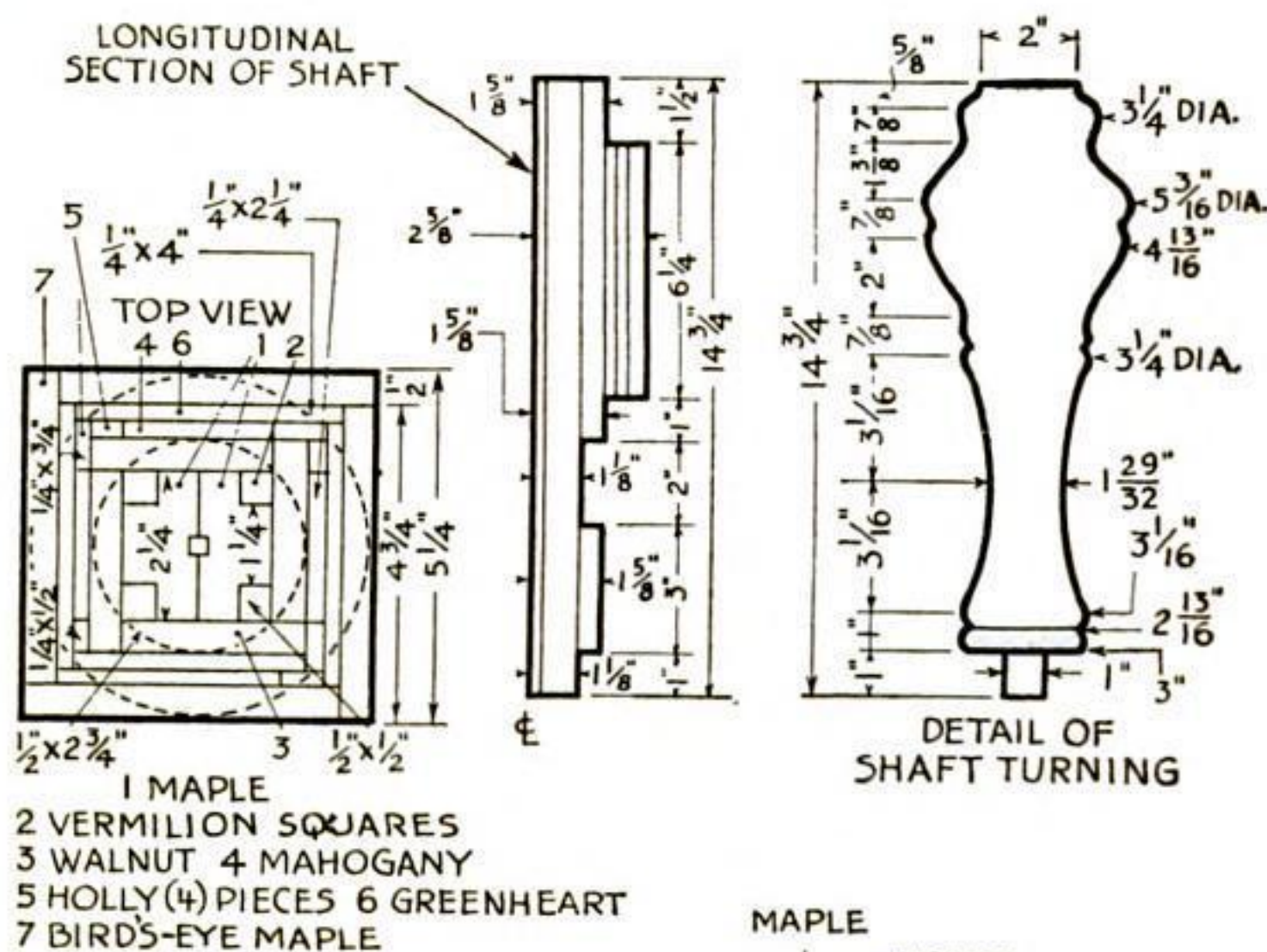


ACCURACY is essential if you wish to reproduce this novel turned lamp, made by John W. Hough, secretary of the Roseland Homecraft and Hobby Club, Chicago, Ill. Each layer must be uniform in thickness with perfectly glued joints, the center core must be a perfect square, and the work must be exactly centered in the lathe.

First, take two pieces of maple $1\frac{1}{8}$ " by $2\frac{1}{4}$ " by $14\frac{3}{4}$ ", plow a groove $\frac{1}{2}$ " wide and $\frac{1}{4}$ " deep, and glue together so there is a square channel in the center for the $\frac{1}{8}$ " pipe through which the electric cord runs. Glue all parts together as indicated and allow at least forty-eight hours for setting. Cut off

the sharp corners with a band saw or circular saw, then turn to shape in the lathe. Do the same with the base and bore the holes as indicated. You can use a French polish on the turning or any finish you desire.

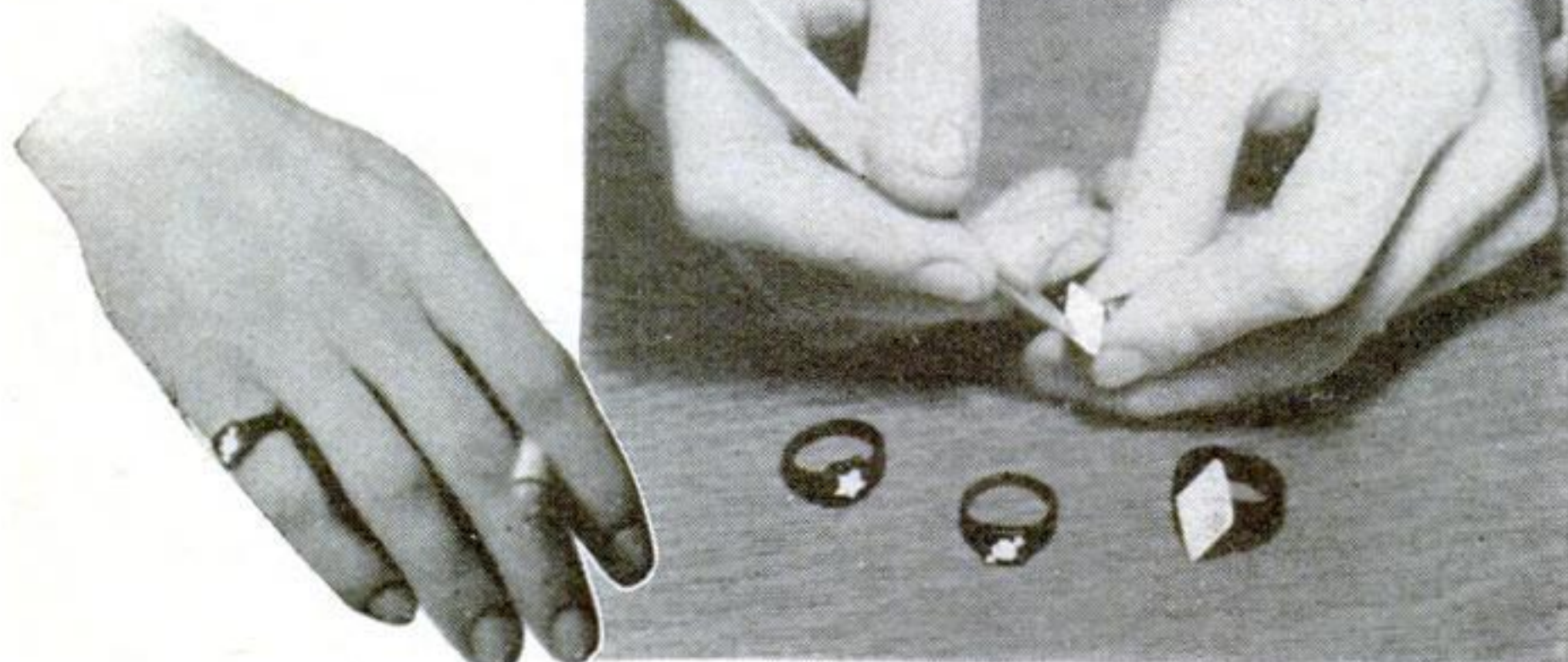
The electrical fixture assembly, consisting of $\frac{1}{8}$ " iron pipe and an adjustable brass extension with finial and two sockets, was purchased by Mr. Hough for about \$2 and the wood for approximately \$3.50.



How the stock is glued up and turned. Care must be taken to watch the inlay pattern as it is developed

Unique Plastic Rings Carved from Bottle Caps

These rings are cut from a hard plastic composition and decorated with mother-of-pearl from buttons



ONLY a sewing needle and a pocketknife were used by C. J. Schilling, of the Euclid (Ohio) Homeworkshop Club, to make these attractive rings. The bands are carved from the hard plastic used for the caps on some types of liquor bottles, and the decorations are mother-of-pearl from buttons. Two of the rings are inlaid. The inlays did not require fastening as the fit was sufficiently tight. The other two rings have the pearl dovetailed into the band of plastic material. Initials may be cut to form a design.



new SHOP IDEAS

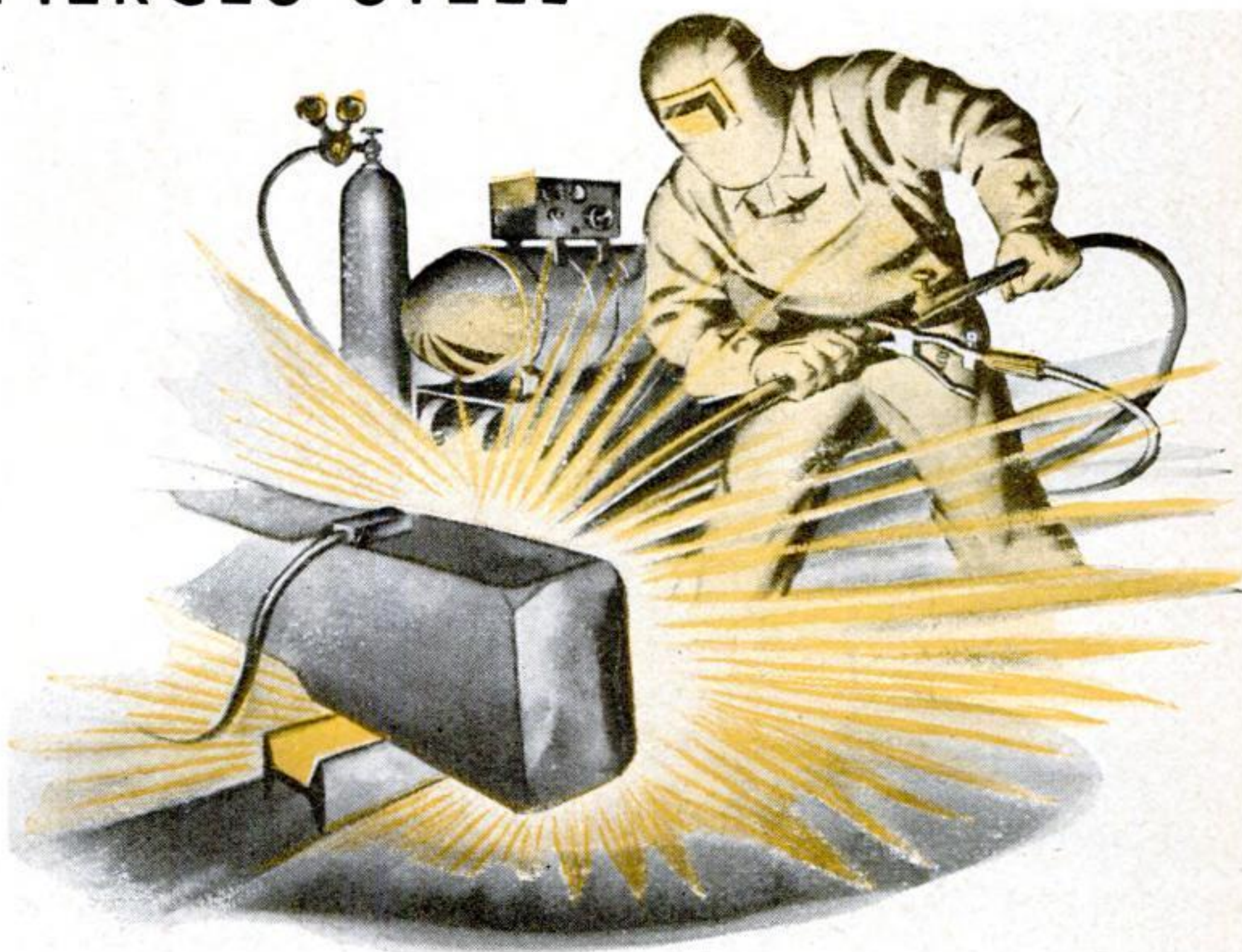


Heavy-Duty Oxygen Lance

CUTS AND PIERCES STEEL

FOR cutting or piercing heavy work that is beyond the capacity of available oxyacetylene torches, a so-called "oxygen lance" can be used as illustrated. For convenience, the lance is usually made of two sections of ordinary black iron pipe, one about 2' long, the other about 4'. The operator then can replace the longer piece when it is consumed. Use no white lead in the joints and bake all pipe to burn any oil in the interior, because oil or grease might produce a violent explosion when the lance was used.

The pipe is connected to the oxygen hose. At the point where the hole or cut is desired, the metal must be preheated, which can be done with a torch. Then the jet of oxygen is turned on, and the steel is rapidly oxidized in a fairly uniform kerf or hole. During the reaction, the lower end of the pipe is consumed,



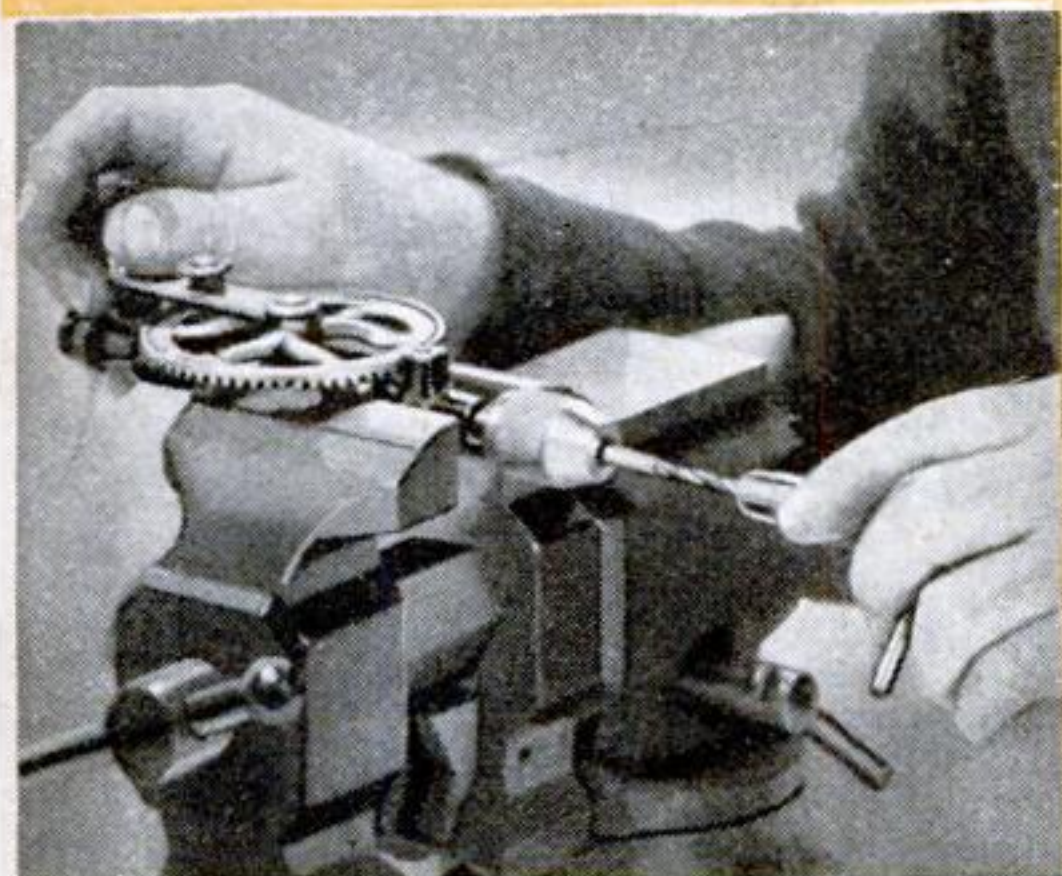
Lance in use. To start the chemical reaction, an electric welder may be employed as shown, or the work or pipe end may be preheated

and the heat of this furthers the oxidization. The steel and oxygen combine to form ferric oxide, which is blown away.

The lance is capable of cutting through very thick steel and is, indeed, employed in tapping blast furnaces. A $\frac{1}{8}$ " pipe at 20 lb. oxygen pressure will cut $\frac{1}{4}$ " plate very rapidly and smoothly and will pierce a $\frac{1}{4}$ " hole of remarkable roundness. For thinner sections, even lower pressures are used.

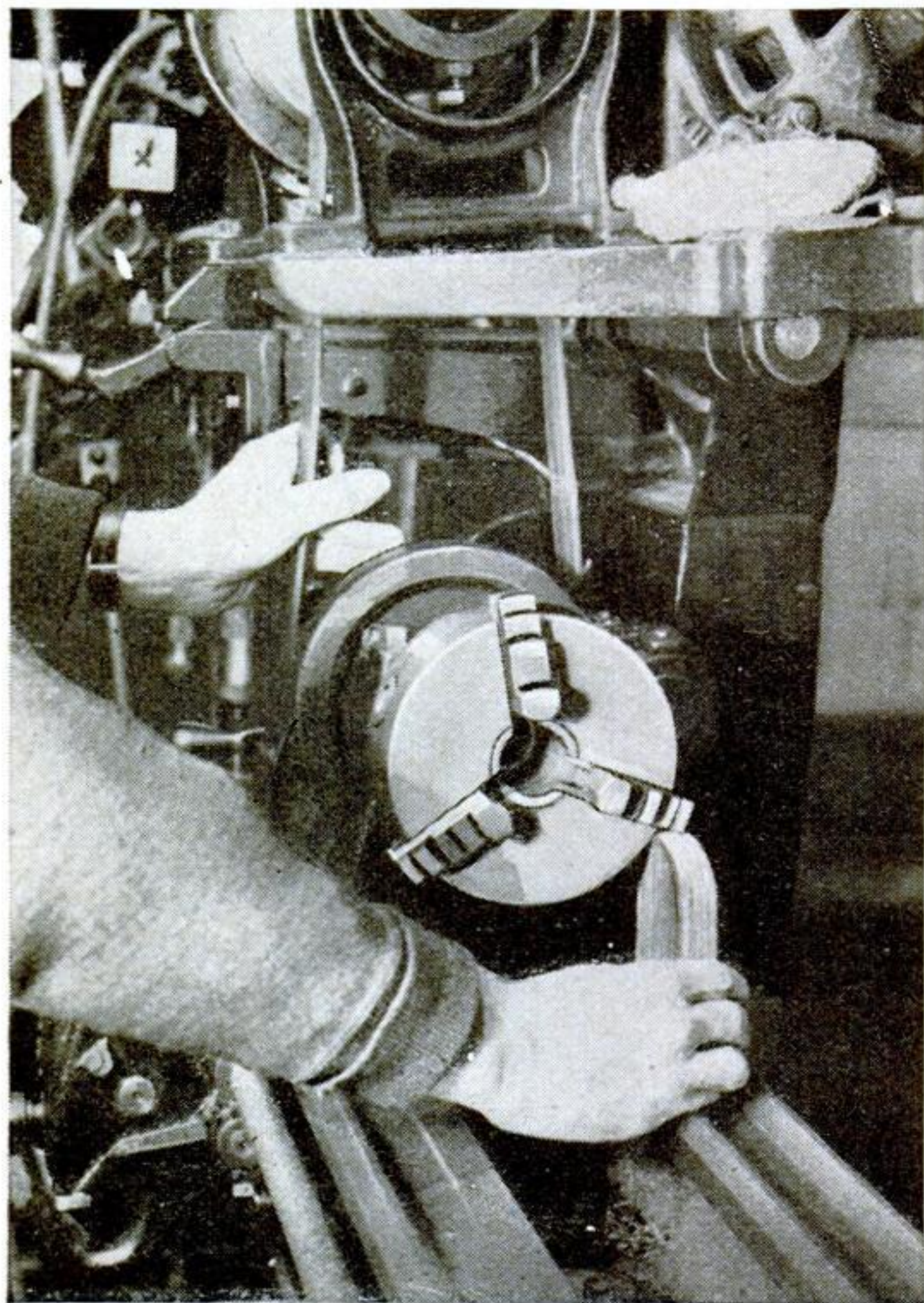
Many operators heat the pipe end of the lance in place of the work, and a recent innovation is to use an electric welding machine for preheating. The electrode holder is clamped on the oxygen lance at the upper end, and the

How to Ream or Tap Short Tubes



WHEN short lengths of tubing have to be reamed out and tapped, the drill or tap will center itself better if the tube is placed in a drill chuck and rotated around the tool as illustrated at left.
—MERLE TERRILL.

ground connection laid on the work, polarity being reversed. The arc is struck and played for about half a minute, after which the oxygen is turned on for the cut. To discontinue the arc, the operator merely kicks the ground connection off the work. A current of 100 to 200 amperes is sufficient.—LESTER J. KING.

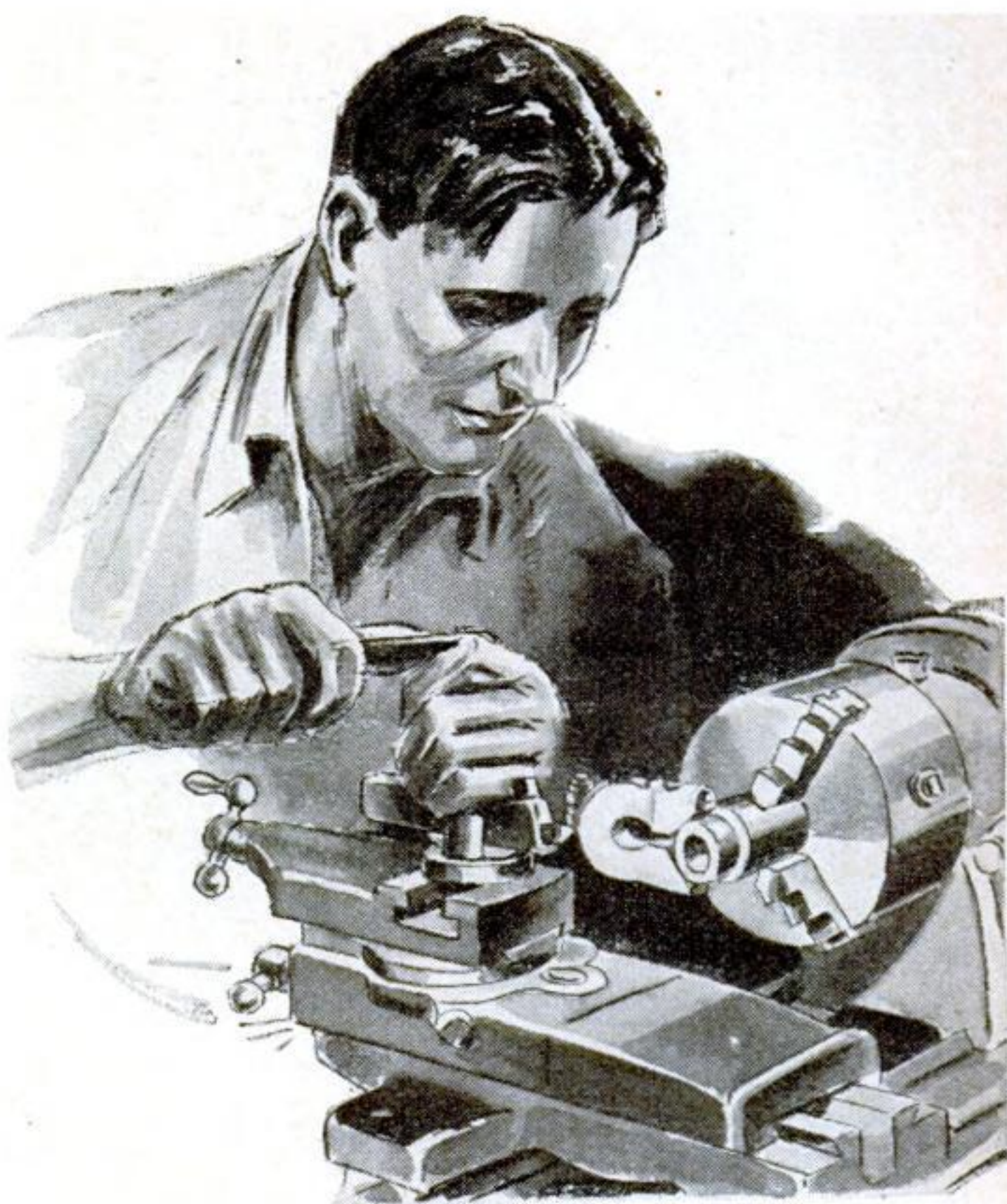


Removing a Lathe Chuck Without Damage

WHEN difficulty is encountered in removing a lathe chuck, experienced machinists use the old trick of placing a hardwood block on the ways of the lathe as shown above. Hold the other end of the block against the outside edge of the chuck and revolve the cone pulley backwards with the other hand. If the spindle drive is inclosed, throw the motor switch in and right out again in the reverse direction of rotation. The jaw of the chuck strikes the block a sharp blow, and the chuck may then be unscrewed by hand.

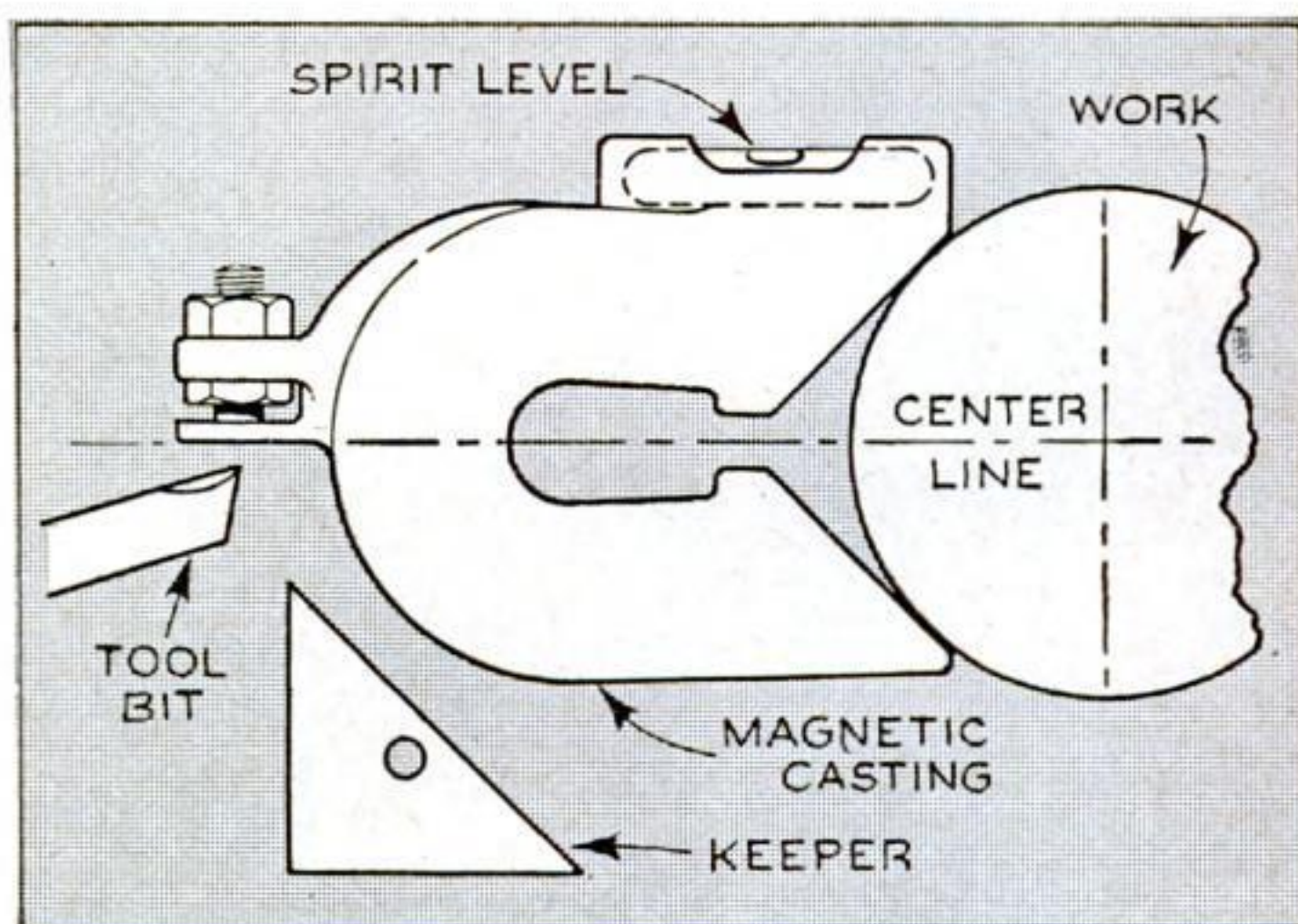
Tightening Loose Saw Handles

SAW handles sometimes become loose because the square shoulders on the special two-piece saw screws wear away the wood. Loosen the screws and cut a new slot with a hack saw in the unslotted end of the screw; tighten by using two screw drivers.

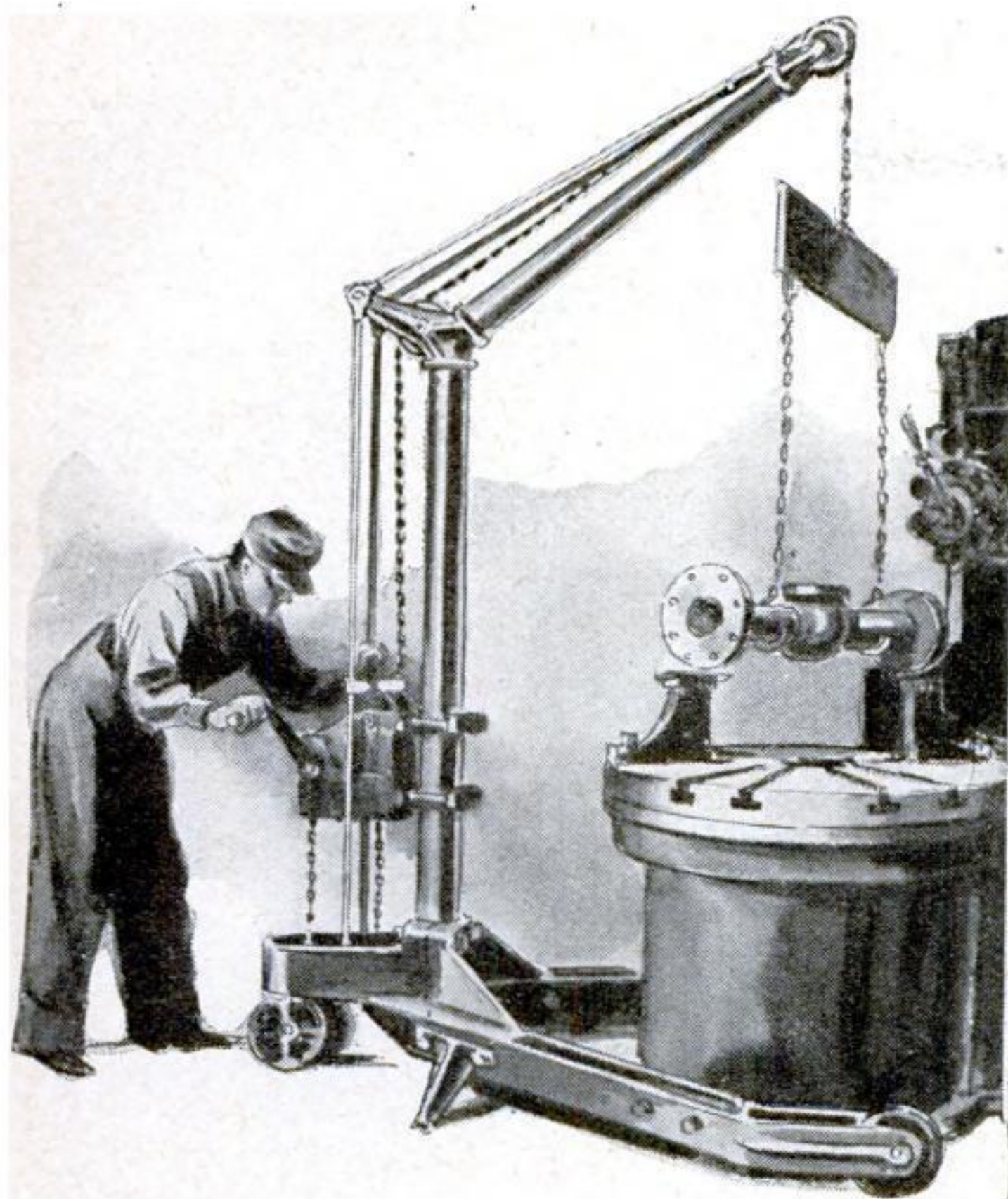


Magnetic Center Indicator Sticks to the Work

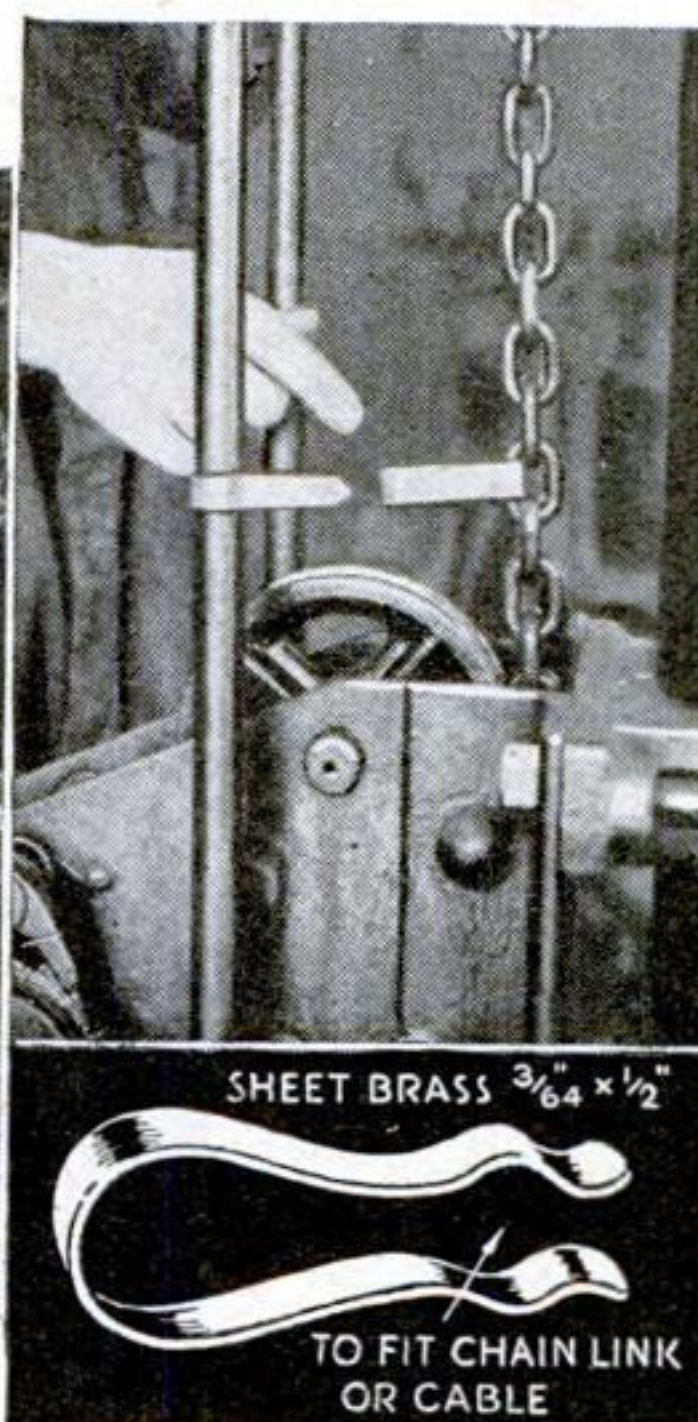
THIS improved center indicator and level for setting lathe tools and other purposes is made from a casting of a new alloy of aluminum, cobalt, iron, and nickel that will support fifty times its own weight when magnetized. It therefore sticks to the work, leaving both hands free. The casting has to be made complete as shown, even to the holes for the spirit level and the adjustable abutment, because the alloy is so hard it cannot be drilled. It may, of course, be ground or soldered. For internal boring or thread cutting, it may be set by the tailstock spindle, the outside of a chuck or faceplate, or by a light cut made on the outside of the work to be machined.—GEORGE J. MURDOCK.



Machinists are making these improved indicators and levels from special castings, which come magnetized



Height-Marking Clips Used on Shop Hand Crane

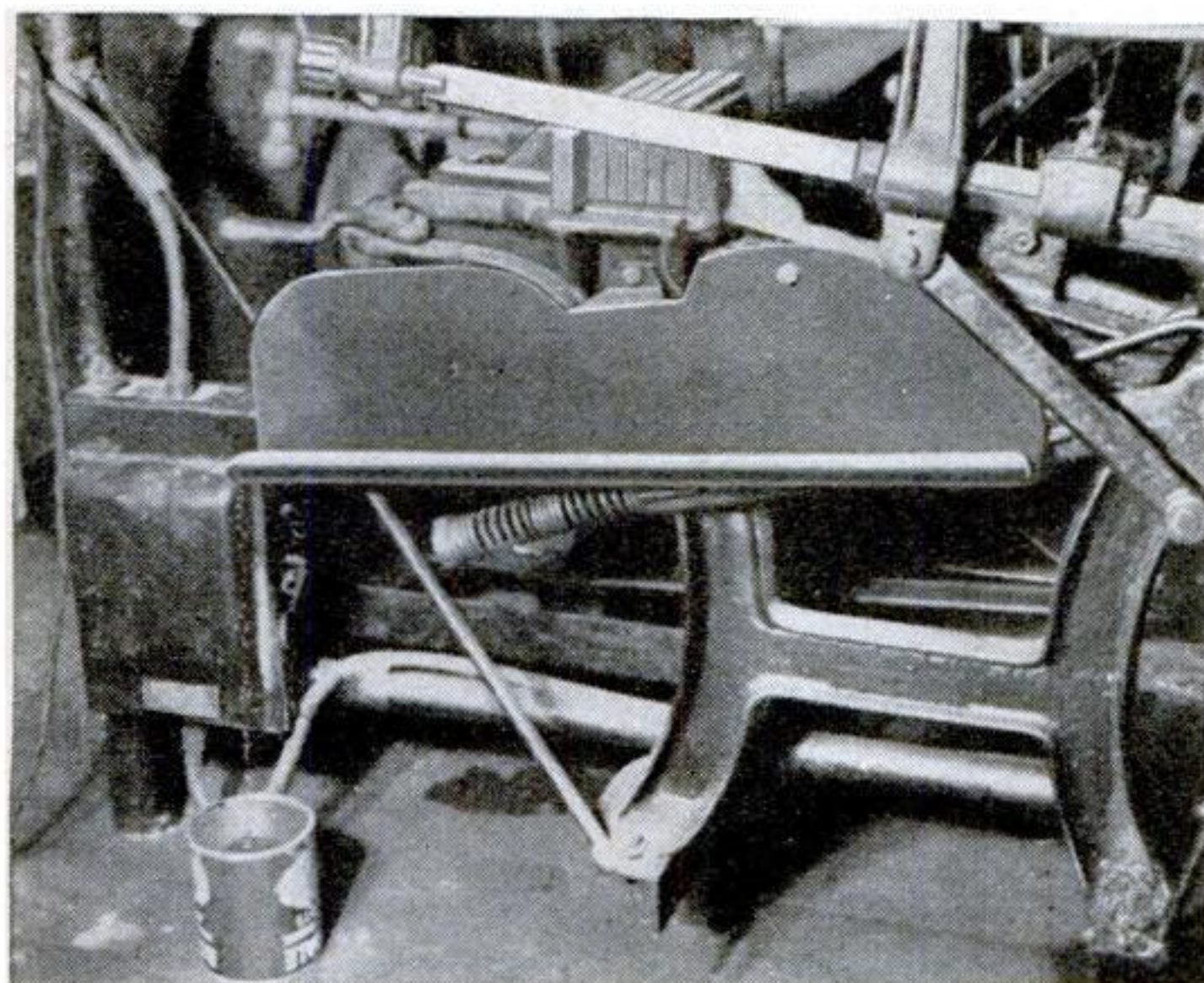


The two indicators show how far to hoist the casting in order to clear any obstructions. The clip for the chain or cable is bent from brass

WHEN heavy castings have to be set on a drill press, boring mill, or other machine tool with a hand crane, considerable time and effort may be saved if a removable metal clip is used on the chain, as illustrated at the left, to mark the exact height at which the casting will clear tool posts, chuck jaws, or other parts or fixtures. Opposite this clip place either another metal pointer clip or a paint mark. The clip also can be used on cable hoists for similar measuring operations.

Sheet-Metal Apron Reduces Wear of Power Hack Saws

MUCH of the wear in power hack saws, especially if of old style, is caused by saw cuttings that get into the mechanism. To prevent this, a sheet-iron apron may be made as shown below. The size and design of the machine will, of course, govern its shape. It is usually a simple matter to attach it securely to the frame below the saw where it will not interfere with the operation of the machine.



A power hack saw fitted with a substantial sheet-metal apron to keep cuttings out of the mechanism

Safe Grip for Punch or Cold Chisel



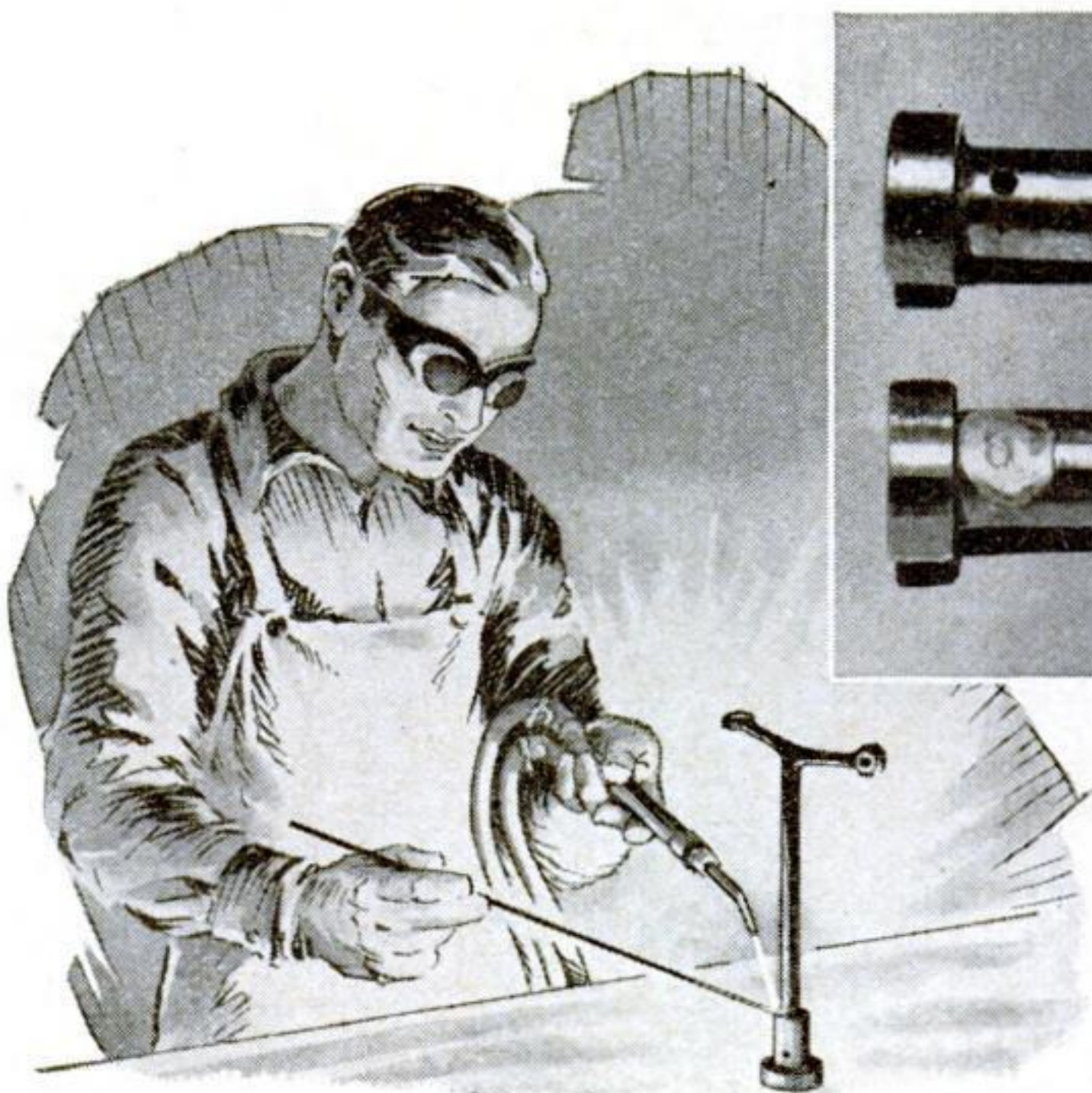
IF YOU watch a skilled mechanic using a cold chisel or a punch, you will see that he almost invariably holds it as shown. Although it may look somewhat awkward, this grip has two advantages. If the hammer should slip, the blow is taken by a part of the hand well protected with flesh—not by the fingers. The second advantage is that the working edge of the tool is visible at all times.—W.C.

Pipe Threading Made Easier by Using Two Separate Cuts

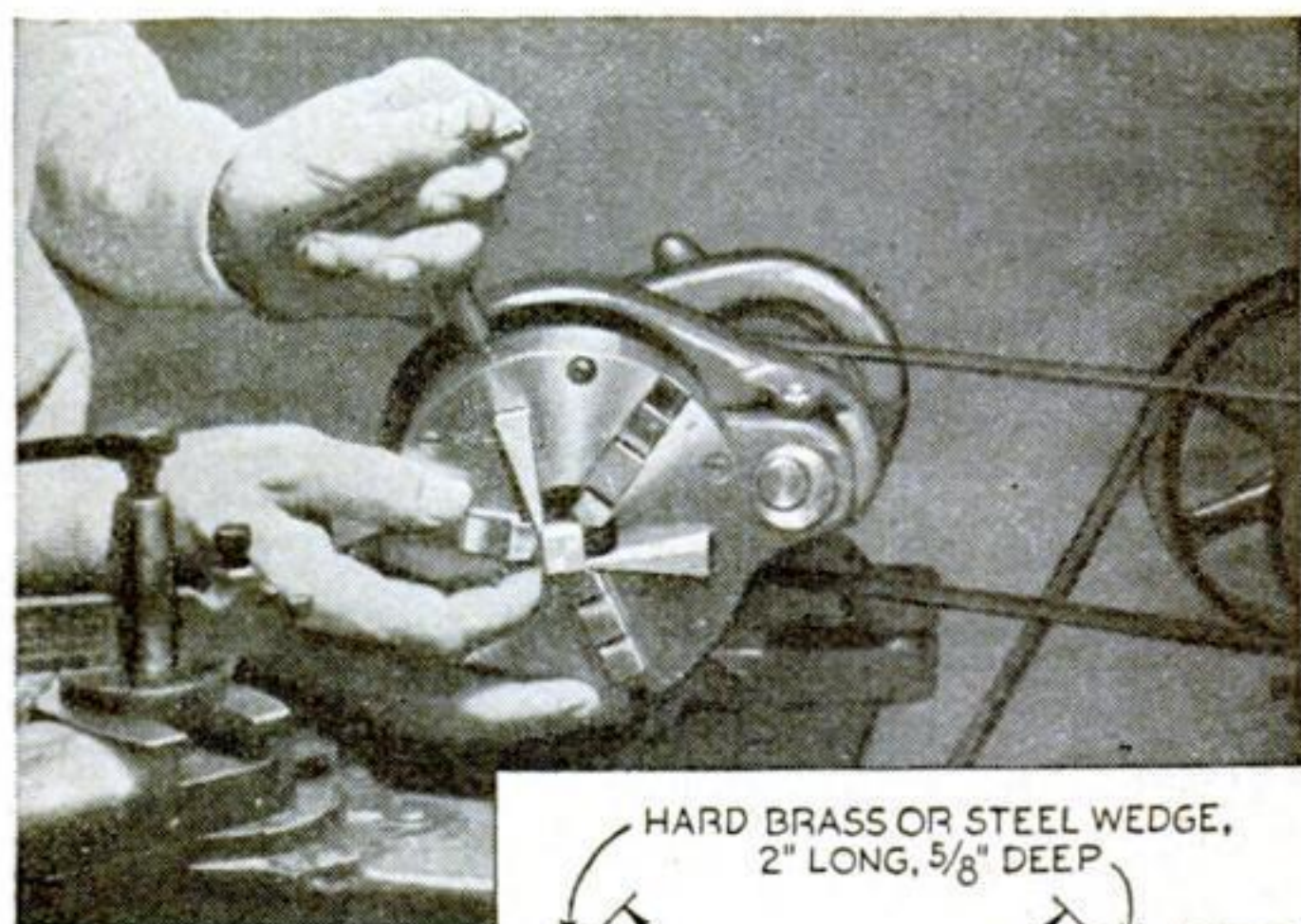
THREADS can be cut much easier on heavy pipe, especially by the amateur, if the dies are first set so they will cut to half of their normal depth. Turn them on the pipe as far as the threads are to go, then back off the tool. Next set the dies to the full depth of thread required and make a second cut on the same threads. When reversing the tool on the second cut, loosen the set screws back of the dies, which will prevent the threads from being torn. Never fail to use oil freely during the operation.—ALBERT SCHANTZ.

Brazing Blind Collars on Ends of Shafts

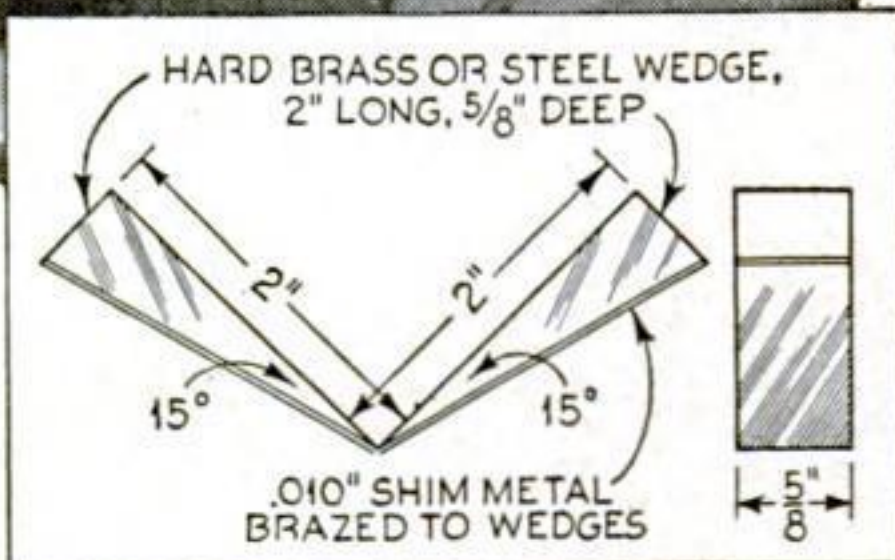
IT IS sometimes necessary to braze a blind collar on a shaft or a solid end in a pipe. The first precaution is to see that the work is vented or serious injury may result because of the building up of pressure in the blind end. In the example illustrated, a small hole was drilled in the sleeve. This relieves any pressure and also shows when the braze is complete, as the brass then runs out of the hole. The work is brazed in a vertical position.



A blind collar to be brazed on the end of a shaft, and the completed job. Note the vent hole. At left, the work is set vertically for brazing



An adapter is made as at the right and used as shown above



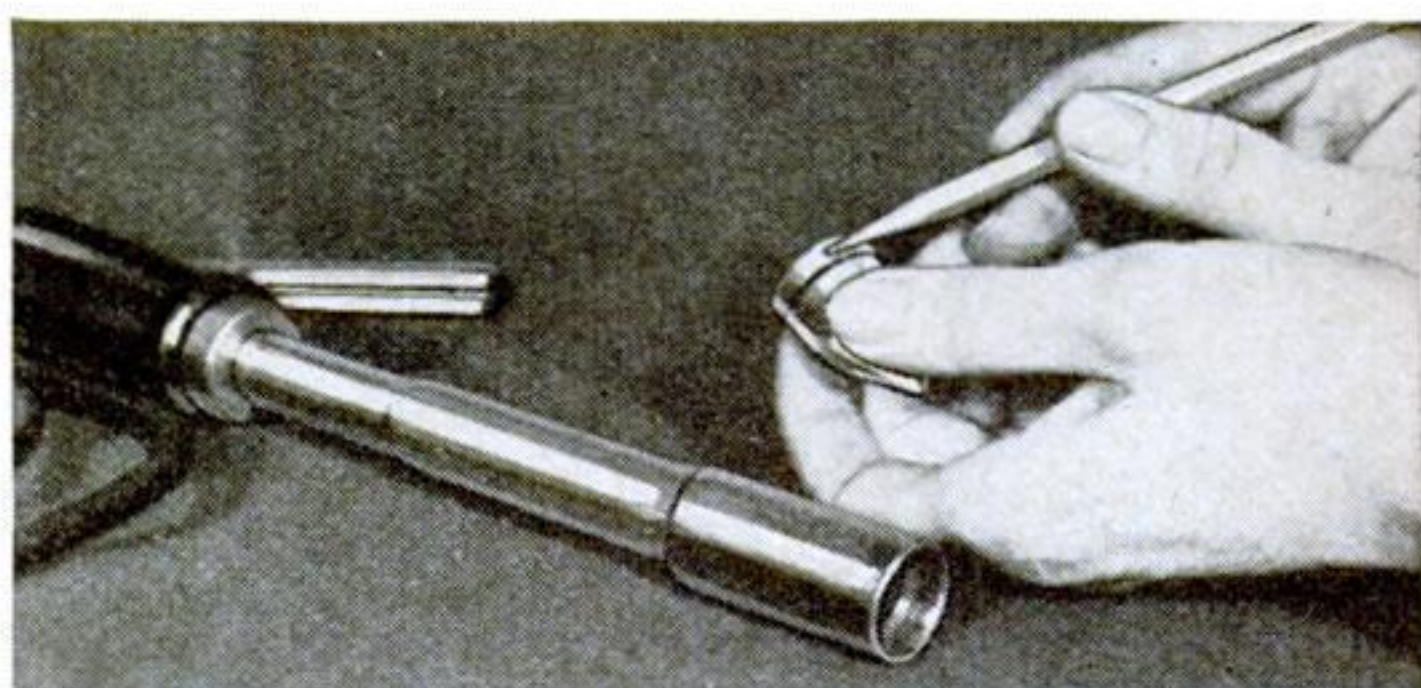
Holding Square Work in Chuck

SQUARE work can be held in a three-jaw scroll chuck for facing or center drilling by making the simple adapter shown from either hard brass or steel. There is then no necessity for changing to a four-jaw chuck or for jockeying independent jaws in order to center the work.

The two wedges, which are brazed to a piece of shim metal, give an included angle of 90 deg. to fit the work and an outside angle of 120 deg. to suit the chuck jaws. The apex of the angle should be placed exactly opposite one of the jaws, and it is well to scribe a reference line on the opposite chuck face centered through this jaw in order to insure accuracy.—G. F. LAMPKIN.

Graphite Lubricates Threads of Soldering-Iron Tips

TO PREVENT the threaded tip on an electric soldering iron from sticking, apply a little graphite periodically either with a regular graphite applicator or by rubbing a soft lead pencil on the threads. It will then be found that the tips can be more easily interchanged. Never use grease or oil for this purpose because the heat will cause the lubricant to carbonize.—W. C. WILHITE.



A soft lead pencil is rubbed over the threads of an electric soldering-iron tip to insure easy removal

Tool for Setting Leather Fillets

FOR setting leather fillets in the corners on wooden patterns, suitable tools may be prepared by soldering balls of different sizes from old ball bearings into the slightly flared ends of copper tubing. Where permanence is not of great importance, modeling clay may be used in place of the leather fillets. If the steel ball sticks to the clay, moisten it slightly.—L. COPLESTON.



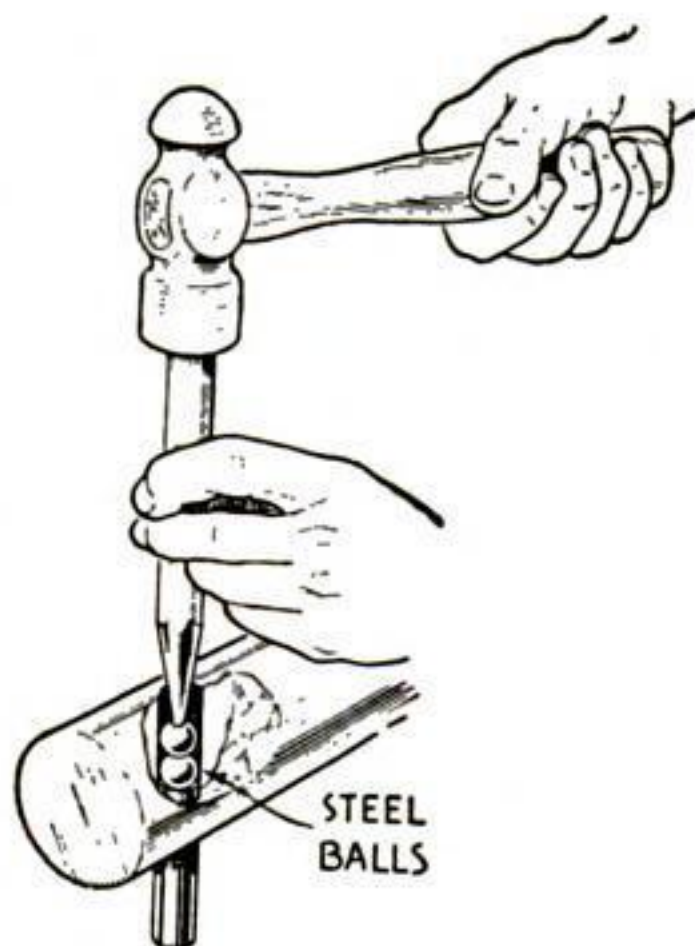
Using a light rope to turn a vise screw when the work requires both hands to be free to hold it

Vise Adjusted with Rope Looped Around Foot

SOMETIMES it is necessary to clamp several pieces of metal or wood together in a machinist's vise or the work is of such a nature, even if in one piece, that both hands are required to hold or adjust it while it is being placed in the vise. In such an emergency, you can adjust the jaws with your foot by the method illustrated above and have both hands free for taking care of the work. Simply tie a light rope to the vise handle, wrap it around the vise screw several turns, and make a loop in the lower end of the rope to fit over your shoe.—M.T.

Steel Balls Help to Remove Pins from Long Holes

IF YOU have no pin punch long enough to finish driving a pin from a long hole, simply remove the punch when it begins to bind and drop one or more steel balls from an old ball bearing into the hole. To be effective, the balls should be nearly the diameter of the hole. Then use the pin punch as usual.



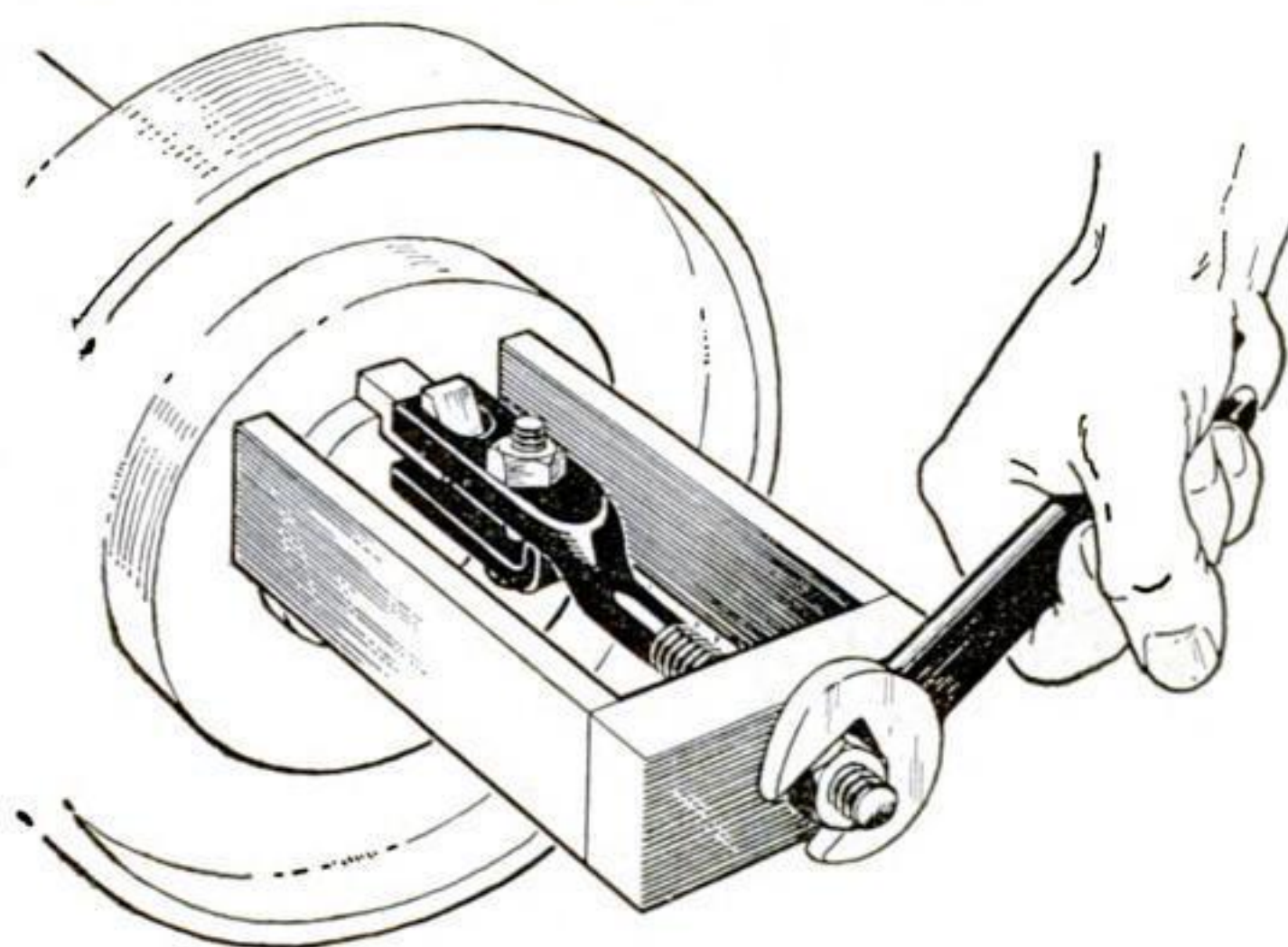
Tire-Valve Nuts Act as Small Reducers

CERTAIN types of pipe fittings are often hard to obtain in the smaller sizes. I recently required some reducers for connecting $\frac{1}{8}$ " and $\frac{1}{4}$ " pipe, but could not obtain commercial fittings, so I used the valve nuts from old inner tubes. The inside threads run easily over the threads of $\frac{1}{8}$ " pipe, while the outer threads match the $\frac{1}{4}$ " fittings. A coupling is used as shown at the right.—W.W.



A Heavy-Duty Key Extractor of the Clamp-on Type

MACHINE keys with heads can be removed readily with the clamping type of extractor shown below. It is made from a bolt of suitable size, forged out flat, slotted to fit the head of the key, and drilled to take a clamping piece below the key head. The device is used with a "strong back" and two distance pieces or spacers, which may be any available scrap metal.—C.H.W.



Removing a gib-head machine key with a puller made from a bolt and used with a "strong back"

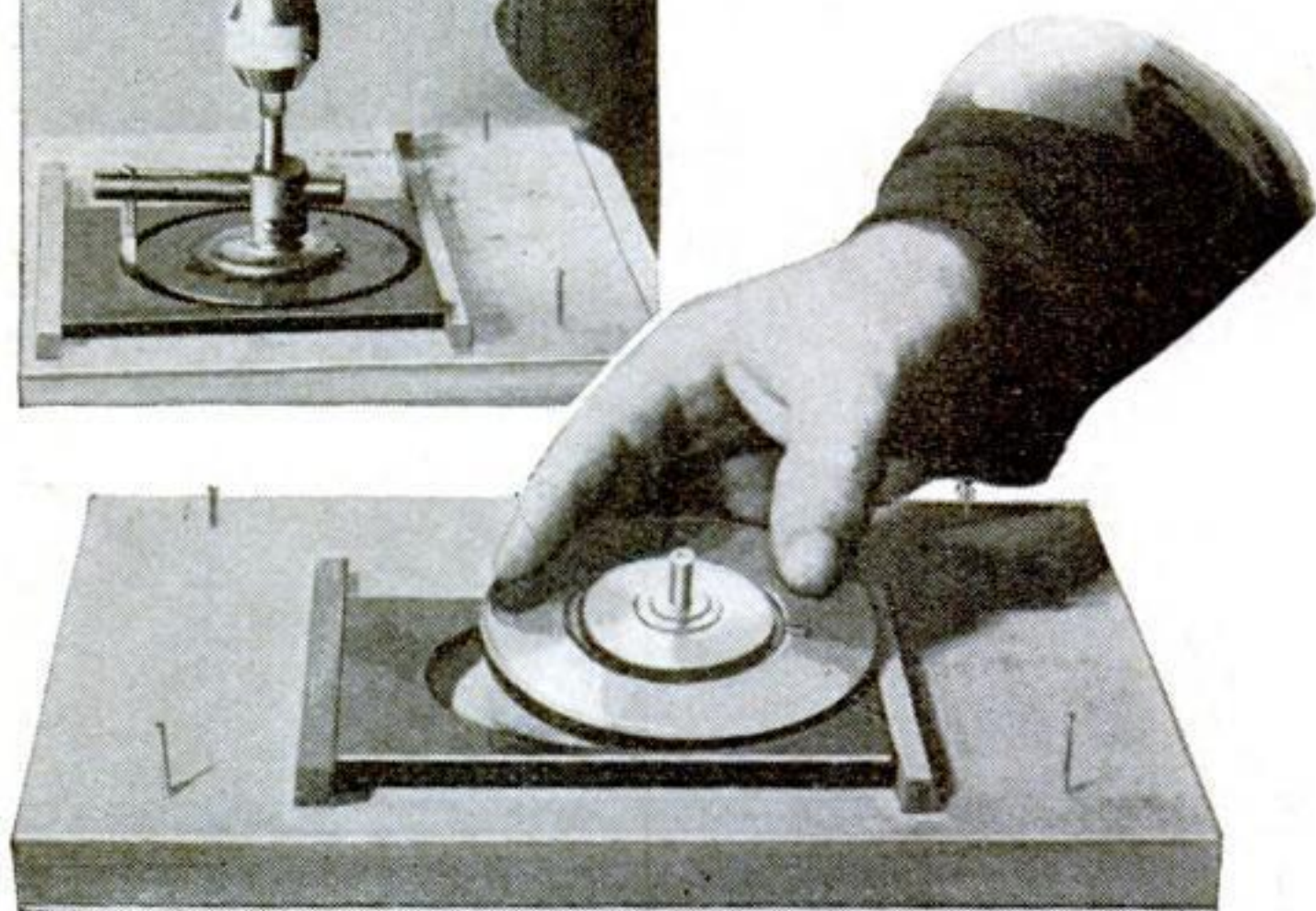
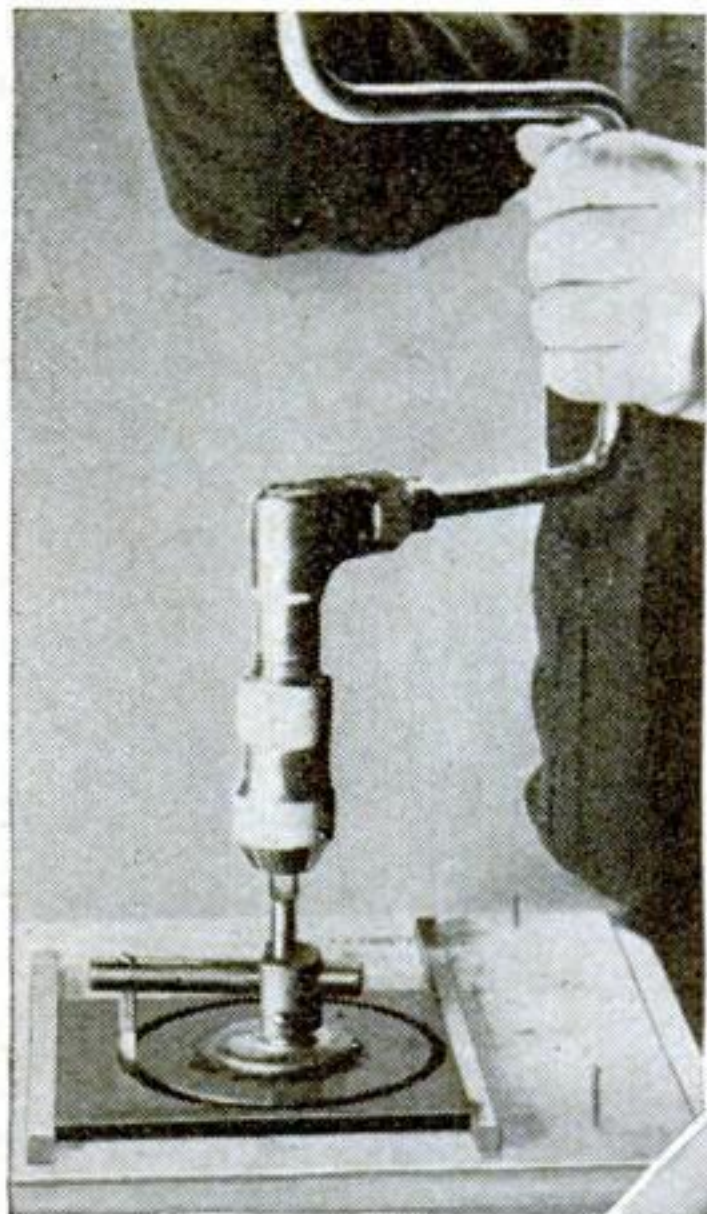
Easy Way to Clean Crooked Tubing

AIR-LINE mechanics and others often find it difficult to remove small particles from long, crooked tubing or piping, which cannot be sufficiently cleaned by washing alone. A quick method is to tie a knot in the end of a string, place the knotted end in the tubing, and use the nozzle of a compressed-air line to force the string through the tube. It will do this regardless of how crooked the tubing may be.—EARL GRAY.

Circle Cutter Makes Disks Without a Pilot Hole

SOMETIMES it is necessary to cut a metal disk with a circle cutter in such a way that it will be solid, without the usual small pilot hole in the center. This can be done by removing the drill from the circle cutter and soldering a short piece of rod or tube to the metal as a pivot. For cutting similar disks in plastics and other material that cannot be soldered, the rod is first soldered to a large washer or disk, and this in turn is cemented to the material to be cut. In that case use a

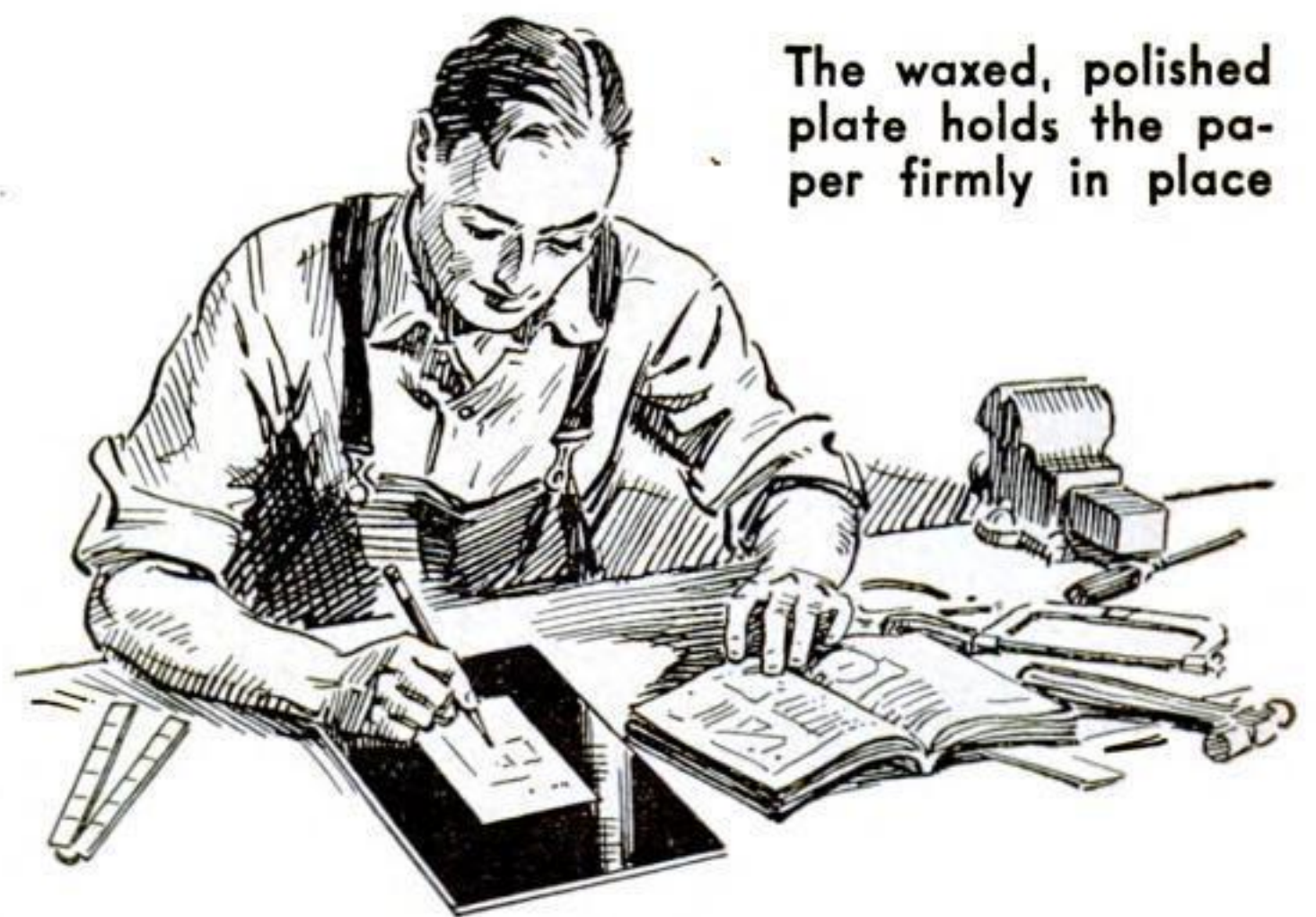
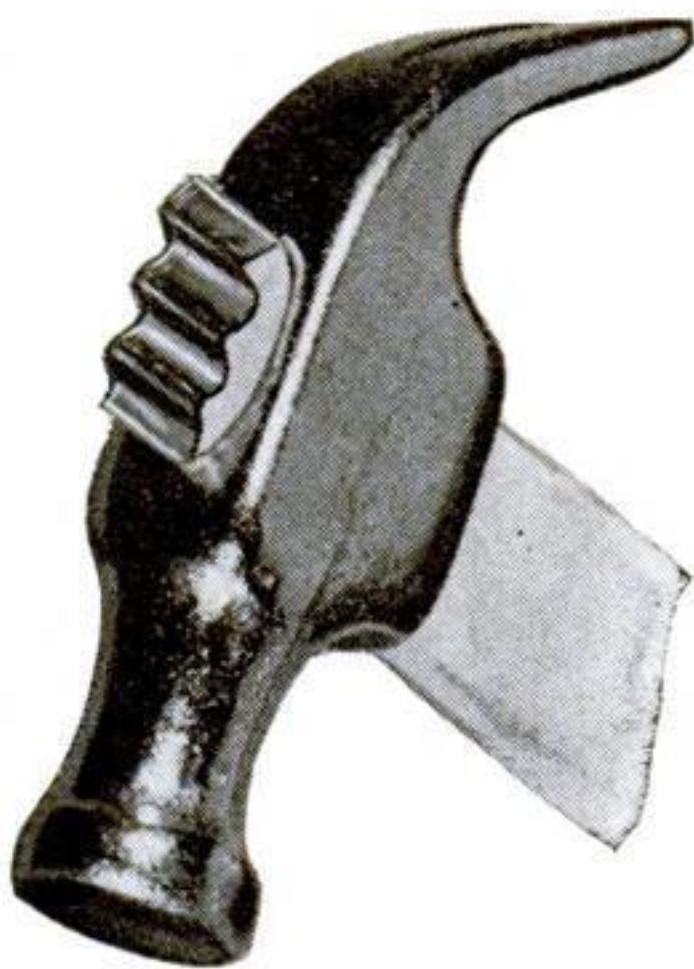
water-soluble glue so the washer can be removed easily without damaging the completed disk. To keep the piece of plastic from turning, tack strips of wood at two ends as demonstrated in the photographs.



To cut plastics, the pivot is soldered to a metal plate, which is cemented to the material

Corrugated Fastener Serves as Wedge for Tack Hammer

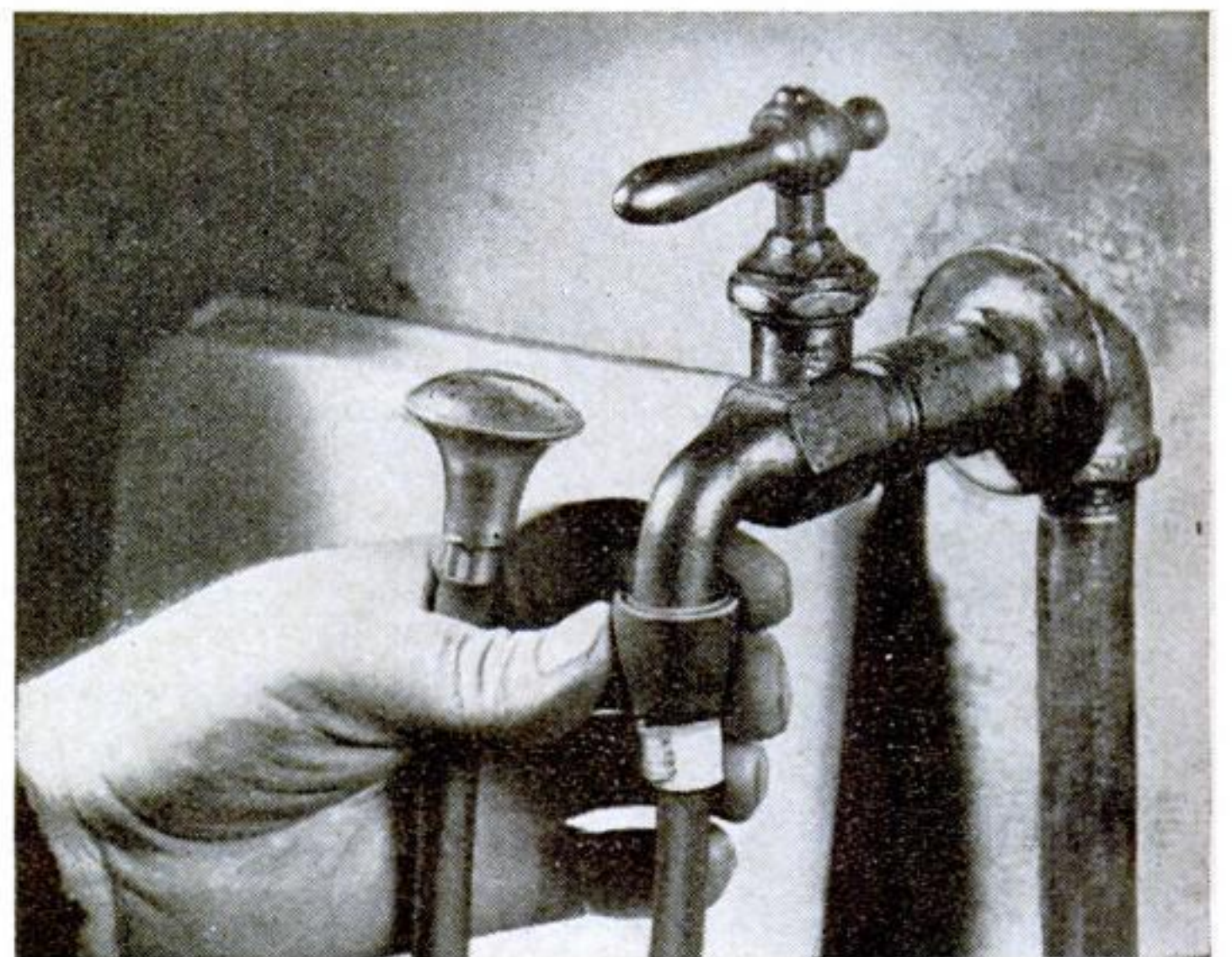
FOR holding the head on the handle of a tack hammer or other very small hammer, an ordinary corrugated fastener makes a good wedge. It is driven into the end of the wood as shown. With a large hammer, the fastener can be used in conjunction with a wooden wedge to provide a tight fit.



The waxed, polished plate holds the paper firmly in place

Ferrotypes Plate Forms Good Writing Surface

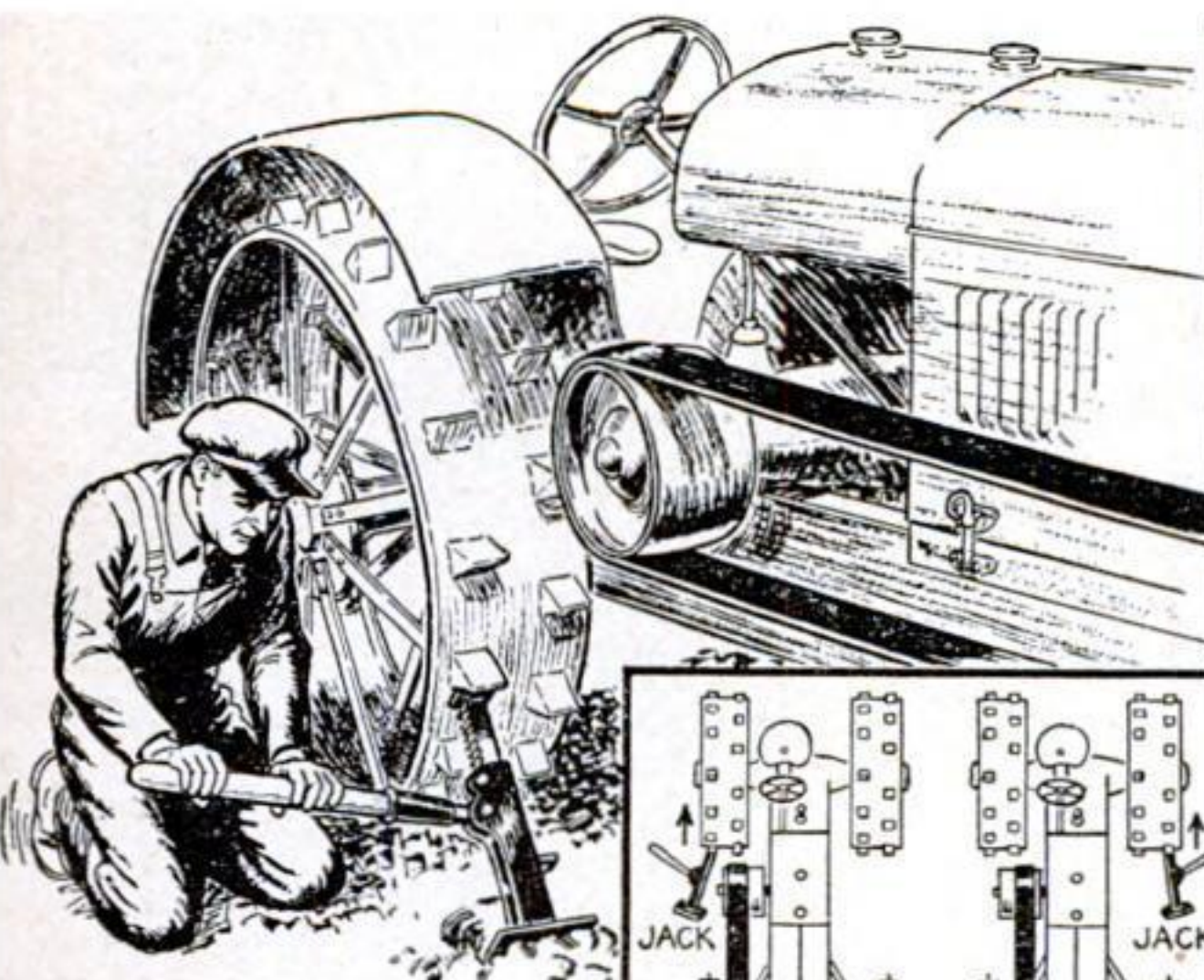
IF IT is necessary to write or sketch on a rough or badly scratched table, desk, or bench top, a good way to assure a smooth surface is to buy an inexpensive 10" by 14" ferrotypes plate at a photographic supply store. A sheet of paper placed on the waxed and polished plate will remain firmly in place, thus leaving one hand of the writer free. For permanent use in one position, the plate may be glued in place. When not in use it may be put away with books or papers or even hung on the wall.—MICHAEL ZUPANC.



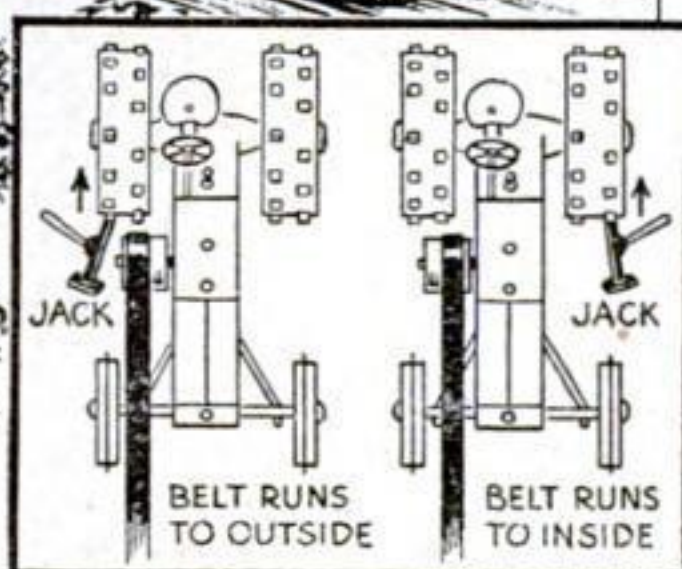
Connecting Rubber Tubing to a Water Faucet

WHEN a connector of suitable size is not available for attaching rubber tubing or hose to a water tap, one can be made from a strip of inner-tube repair rubber. Coat the end of the tubing with rubber cement, and apply it also to the outside of the repair strip. Then wind the latter tightly around the hose to form a coupling that will fit snugly over the water faucet. This idea is particularly useful in the photographic dark room.

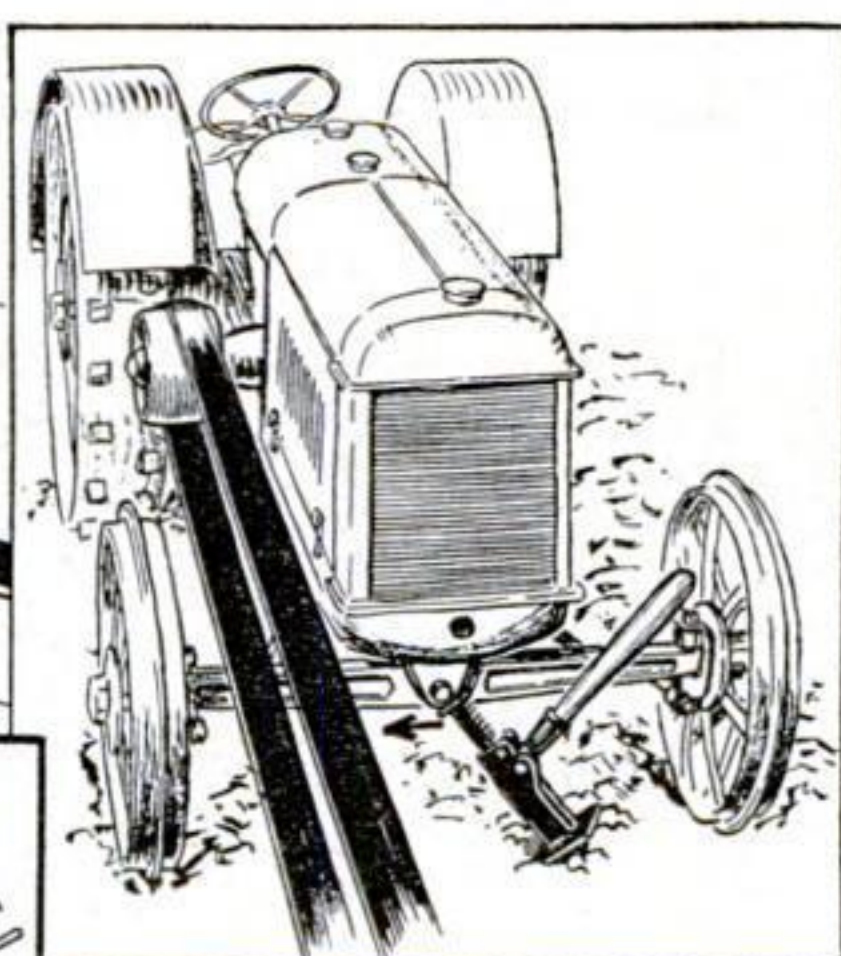
Large Jack Straightens Belt on Tractor Pulley



Using jack to move the tractor slightly



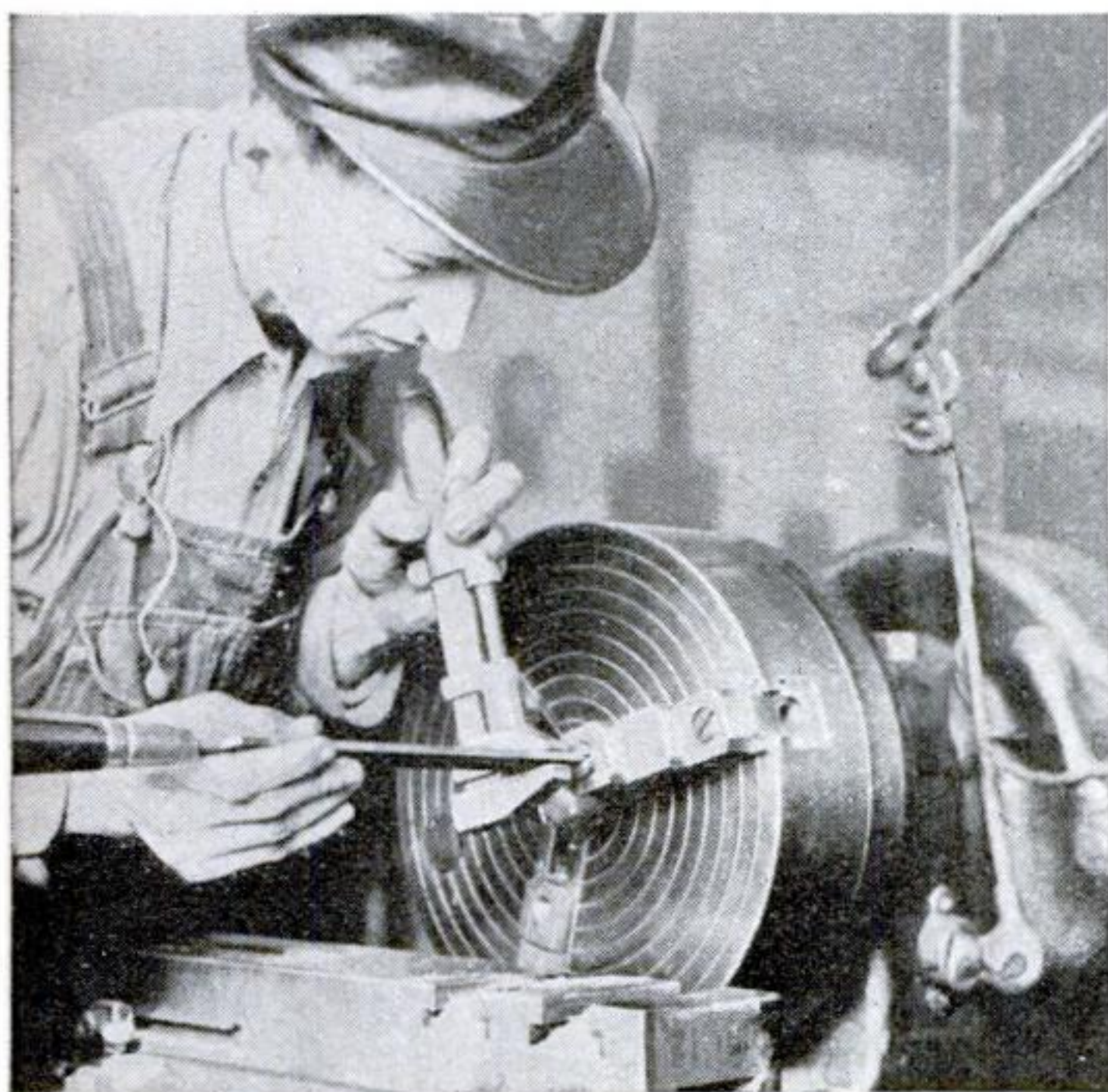
If the belt tends to become too tight, the whole front end can be shifted



pulley on the tractor, it usually may be centered by placing a heavy jack under the rear wheel on the same side, as shown, and backing the tractor slightly. Another way is to dig under the front wheel, if it will not throw the tractor too far off level, and allow the tractor to vibrate itself into the hole. If the belt runs to the inside of the pulley, the same method may be applied on the opposite side of the tractor. Occasionally the belt will

WHEN a tractor is used for power purposes, the topography sometimes makes it difficult to back into a belt perfectly the first time. Often, however, the belt can be straightened while running without waste of time. If the belt runs to the outside of the

become tight before it is brought to the center, but it can still be straightened as shown in the smaller sketch by moving the whole front part of the tractor. If the ground is muddy, a board or plank should be placed beneath the jack.—PAUL F. PODUSKA.



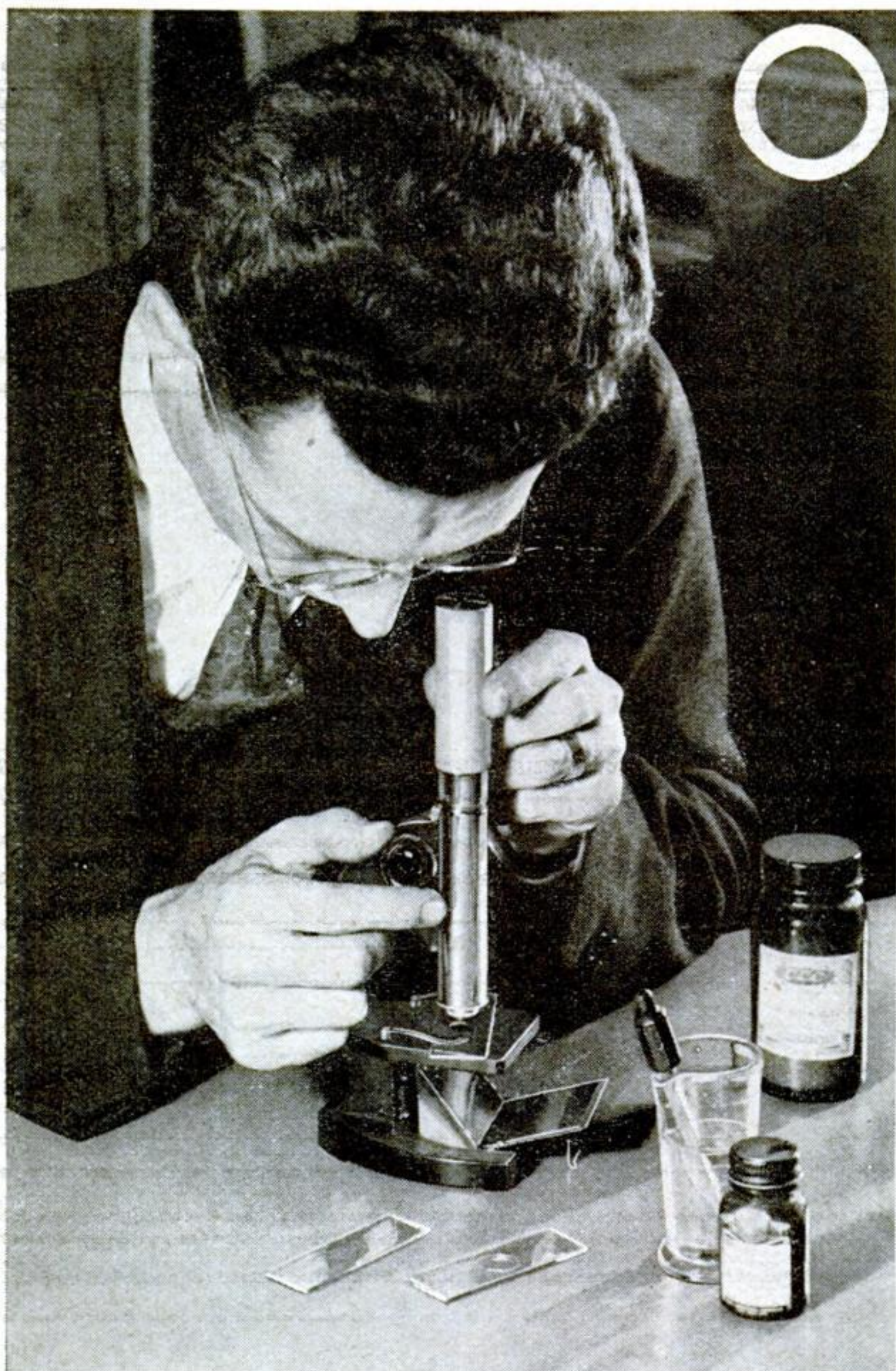
Screw Driver for Heavy Duty

A **LARGE**, powerful screw driver can be made from an old file about $\frac{1}{4}$ " thick. Heat it a cherry-red color in hot coals; then place it on a flat surface, as in the ash pan of a stove, and cover it with some ashes to cool slowly. Grind off some of the teeth on both sides, and grind the end to fit the slot of the screws to be turned. Add a file handle, drill a $\frac{1}{8}$ " hole through ferrule and tang, and insert a rivet. In use, the screw driver is turned with an adjustable wrench clamped near the screw as demonstrated.—O.S.

Roadside Cabinet Displays Pottery and Craftwork

POTTERY, toys, or small craftwork articles can be effectively displayed for sale in roadside cabinets of the type illustrated below. A padlock on the hinged front prevents theft of the goods from the upper compartment. Small shelves may be arranged at the sides for potted plants, and a blackboard at top carries current announcements. If preferred, the lower compartment may be inclosed also, so that both sections may be locked.





One-Way

*With Simple Polarizing Units
and Imitate the Feats Performed*

light is passed through a polarizing unit, the vibrations all take place in one direction perpendicular to the ray.

It's all very much like passing a copy of this magazine through a picket fence. You can hold the magazine in a multitude of positions, from horizontal to vertical; but you will find that it will go through the fence only when it is held in a vertical plane. If there is a second picket fence a short distance beyond, and in the same relative position, you can push the magazine through both of them with ease; but if the second fence has its pickets at right angles to those of the first fence, you cannot force the magazine through unless, between the fences, you rotate it the necessary number of degrees.

Now replace the magazine by a group of light rays vibrating in one plane perpendicular to the direction of travel, and the fences by some polarizing devices or materials,

and you have virtually the same story. The light, at the start, is vibrating in every direction perpendicular to the beam, but only those rays that happen to be moving in the plane that can get through the "pickets" of the polarizing mechanism will continue in a straight line, the rest being thrown off to one side or absorbed.

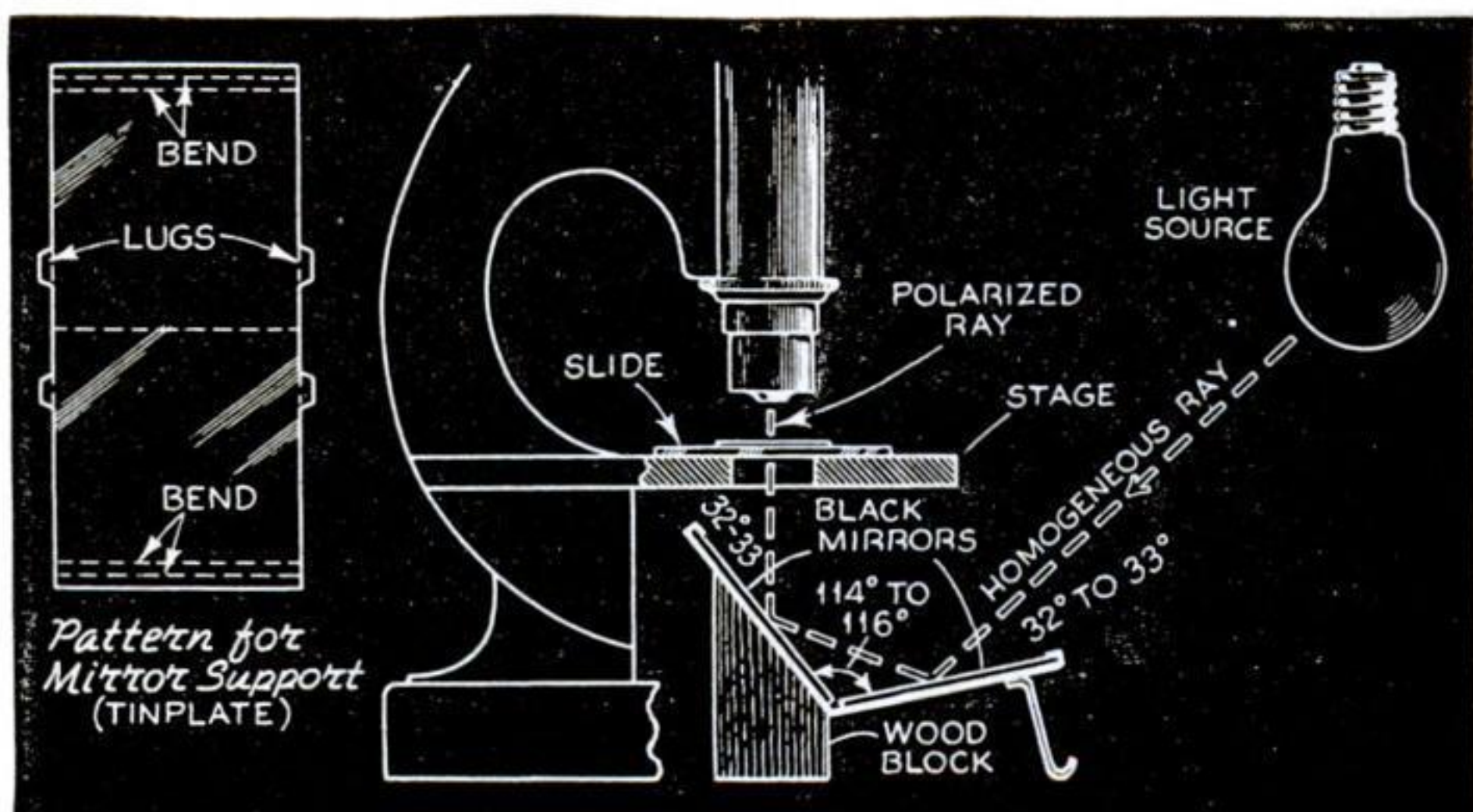
When a second polarizing unit is placed in

Amateur microscope equipped for polarized light, with black-mirror polarizer and eyepiece analyzer

By MORTON C. WALLING

COLORS so gorgeous that they cannot be described; strange, rotating crosses in grains of starch; startling dark-field effects; remarkable differentiation of structure. Those are some of the wonders to be seen by the amateur who ventures with his microscope into the rainbow world of polarized light.

Polarized light is essentially visible radiation traveling in only one direction. If you could observe the mechanism of an ordinary ray of light, you would find that its vibrations are radiating like spokes of a wheel in a plane at right angles to the direction in which the ray is progressing. If the



How the mirrors are mounted and placed under the microscope stage

Light **FOR YOUR** MICROSCOPE

*You Can Explore a World of Wonder
with Expensive Professional Equipment*

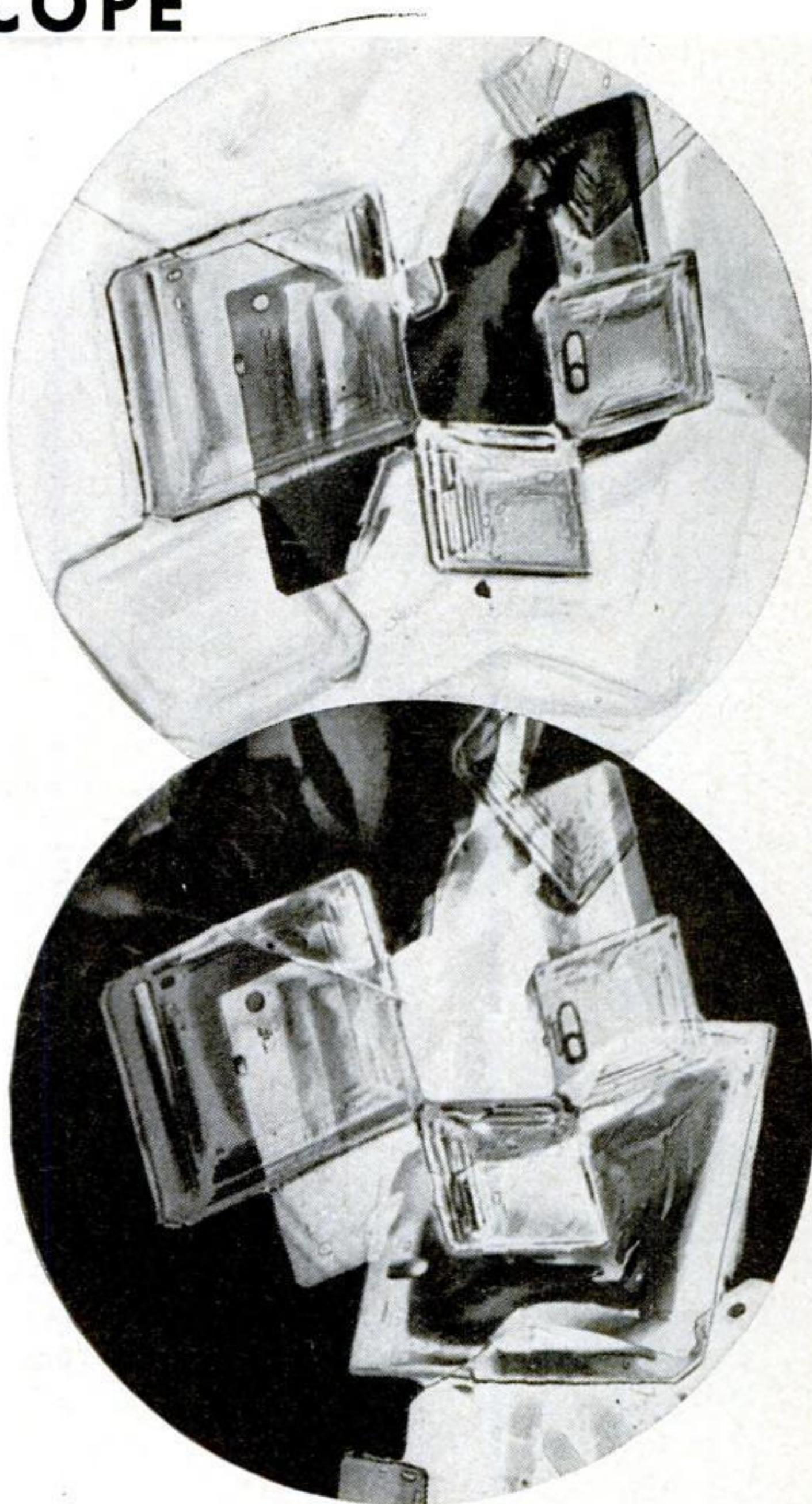
the same relative position as the first one, the ray will pass through it, too; but if it is in a crosswise position, the ray cannot get through unless there is something between the two polarizing units to twist the ray around so it is vibrating in a different direction from that given it by the first polarizer. It is this twisting action, produced by the refractive effect of various materials, that is of interest in microscopy.

When the first polarizing unit (polarizer) and the second polarizing unit (analyzer) are crossed, or placed so that the analyzer will pass only vibrations at right angles to those emerging from the polarizer, no light at all will get through. Now, if a crystal of potassium chlorate, a piece of crinkled transparent cellulose film, or a sheet of mica of proper thickness is placed between polarizer and analyzer, gorgeous colors will be seen (provided, of course, the light is white in the first place). When the crystal or other material is rotated, the colors will change in a breath-taking manner.

To convert a microscope into a polarizing instrument, you must have two distinct attachments, one a polarizer and the other an analyzer. You can, of course, purchase such attachments ready-made. Nicol-prism polarizing equipment has been available for years,



The lamp is set so that its rays strike the outer mirror at an angle of thirty-three degrees

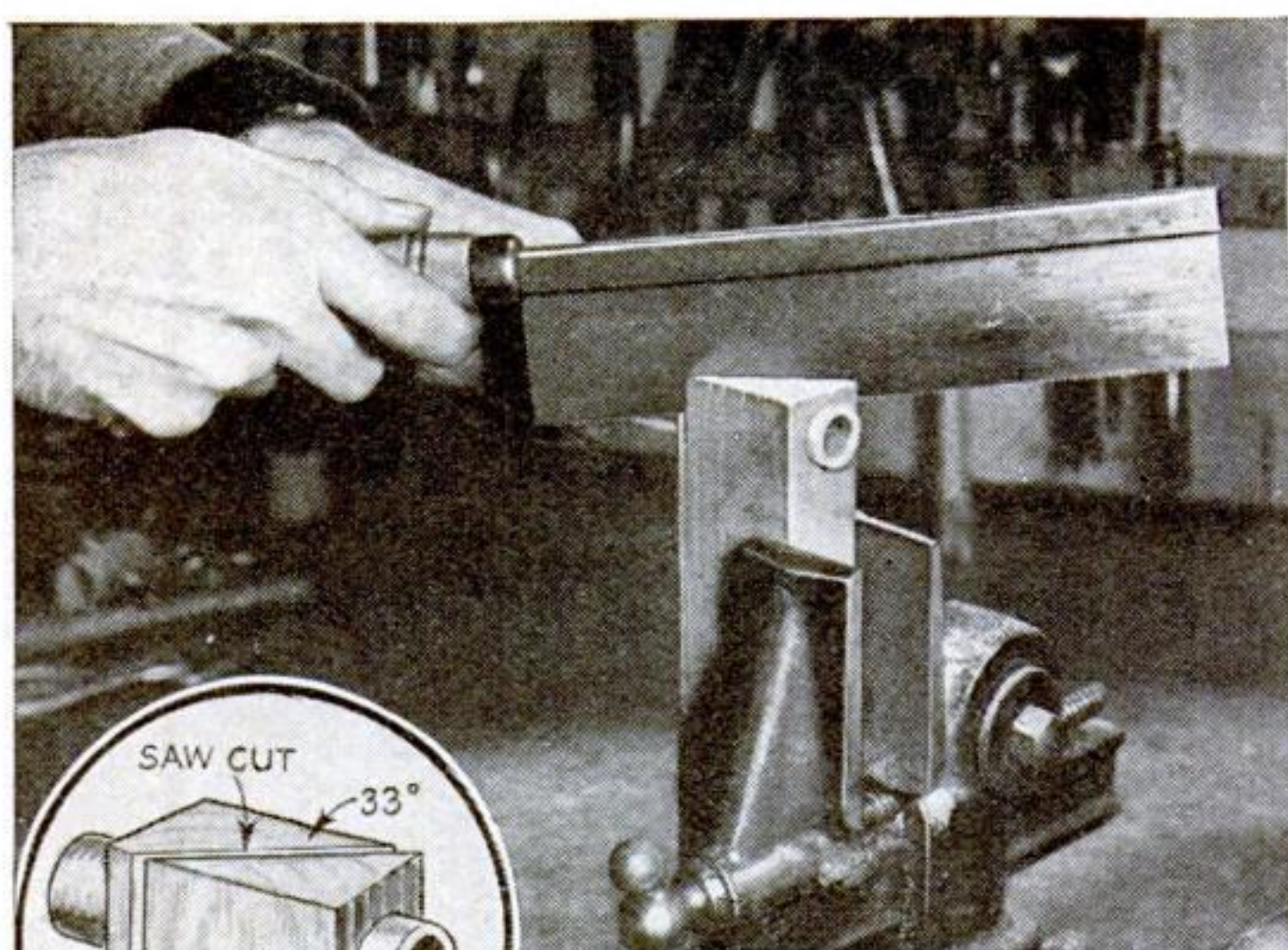


Crystals of potassium chlorate seen by polarized light with the analyzer in different positions

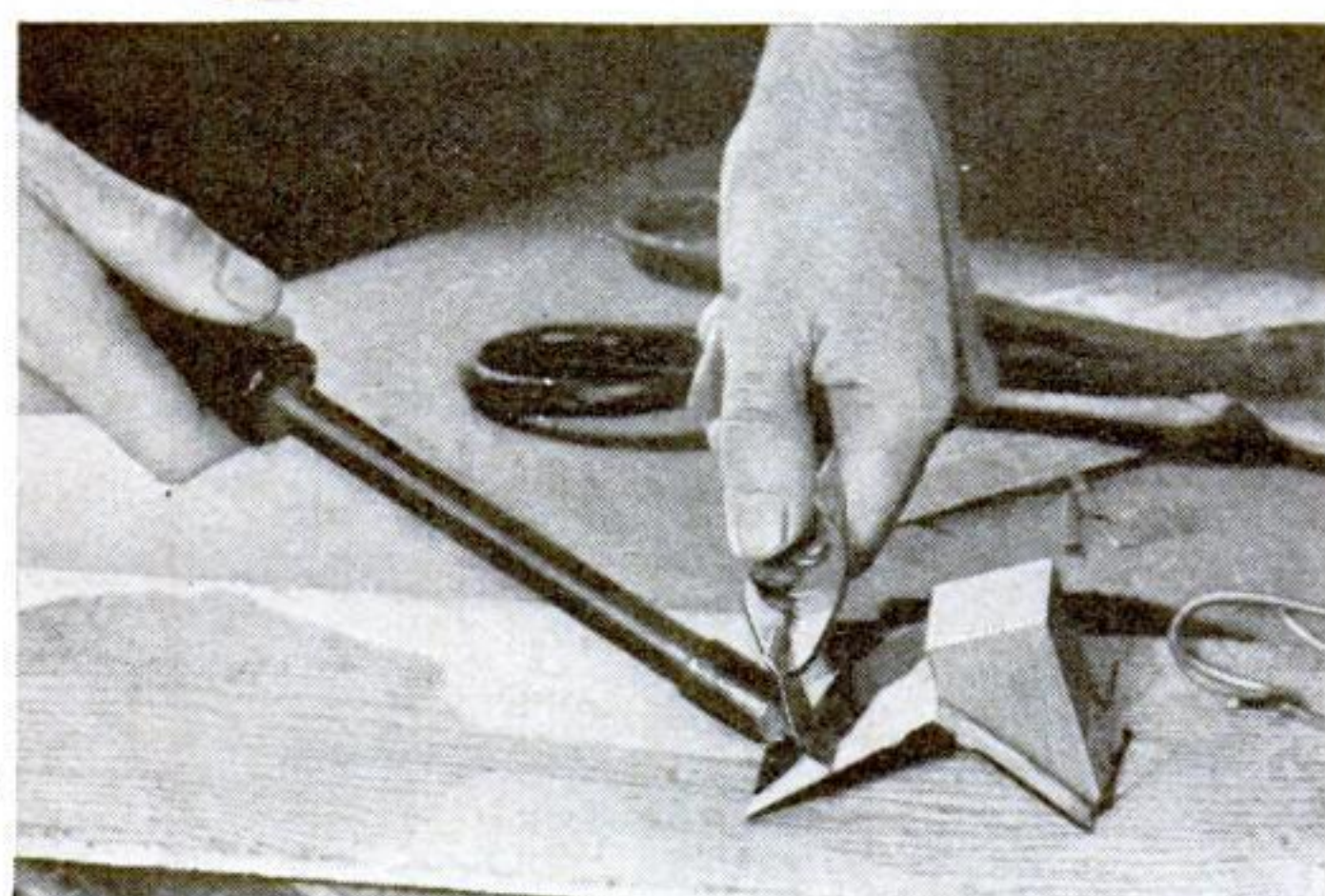
but is, compared to the cost of a typical amateur microscope, prohibitively expensive. Within the last two or three years, less costly sheet polarizing materials have been offered.

However, for a few cents you can construct your own polarizing equipment. First consider the polarizer, which is placed beneath the microscope stage in such a way that it permits light vibrating in only one plane to reach the slide. Perhaps the simplest type to make consists of a pair of black mirrors mounted at the proper angles with respect to each other and to the source of light and the optical axis of the microscope. The illustrations show how such a polarizer can be made from two 2" by 2" cover glasses sold at photographic supply stores for covering small lantern slides.

Clean the glass plates thoroughly to remove



This is one way of cutting the inner analyzer tube to the proper angle



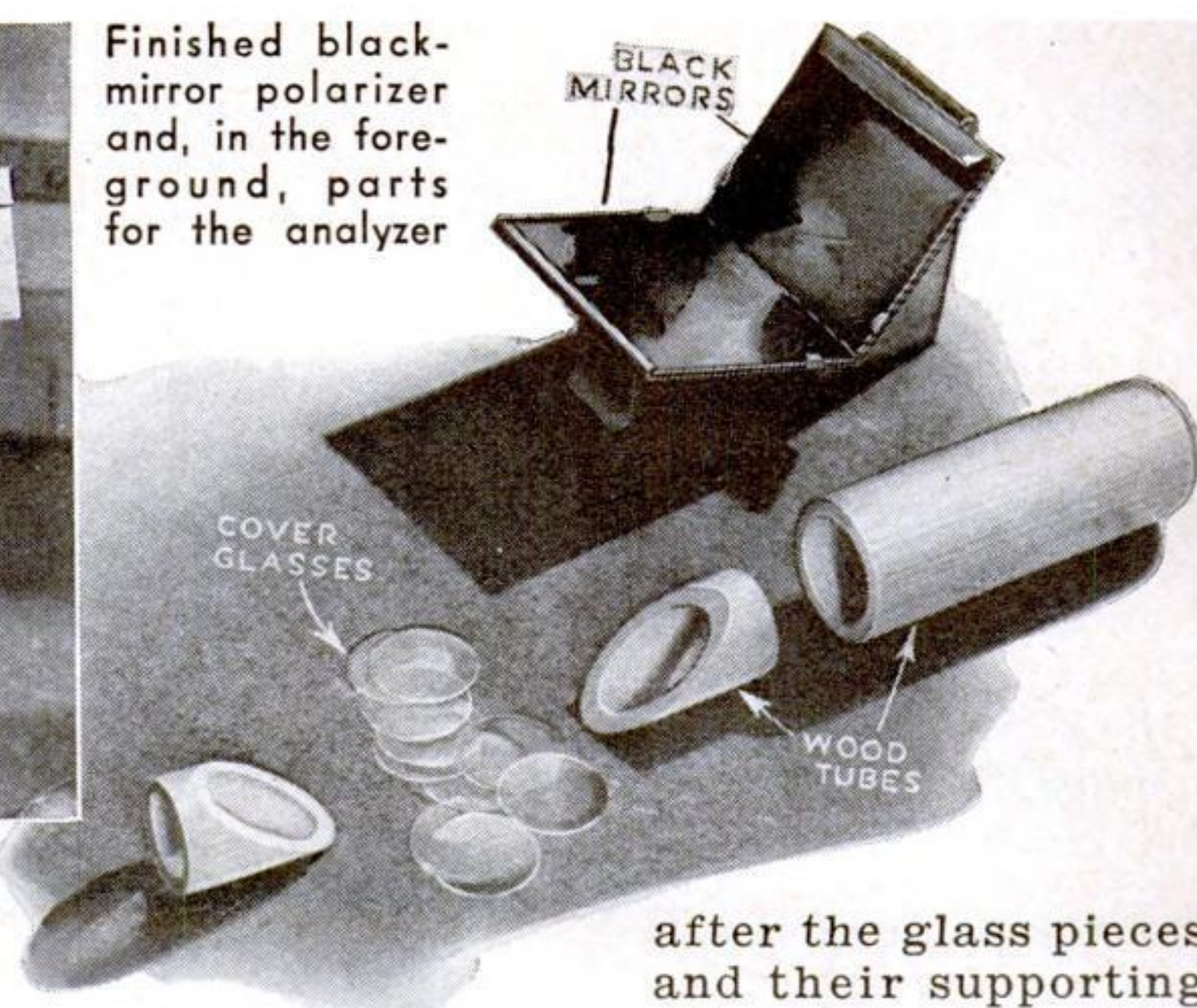
Soldering the leg to the tinplate mirror mount. Right, how the eyepiece analyzer is assembled

grease, and coat one side with black lacquer or enamel, applied thickly enough to form an opaque covering. When this is dry, the plates of glass, which have now become black mirrors, are ready to mount. A rectangular piece of tinned sheet iron, taken from an empty tin can, cut and bent as shown, forms the support.

The analyzer, which is mounted on the upper end of the microscope tube, consists of a pile of about fifteen thin cover glasses of the type used over objects mounted on microscope slides, tilted at an angle to the optical axis of the microscope. They are held in a tube made of wood as shown in the illustrations accompanying this article.

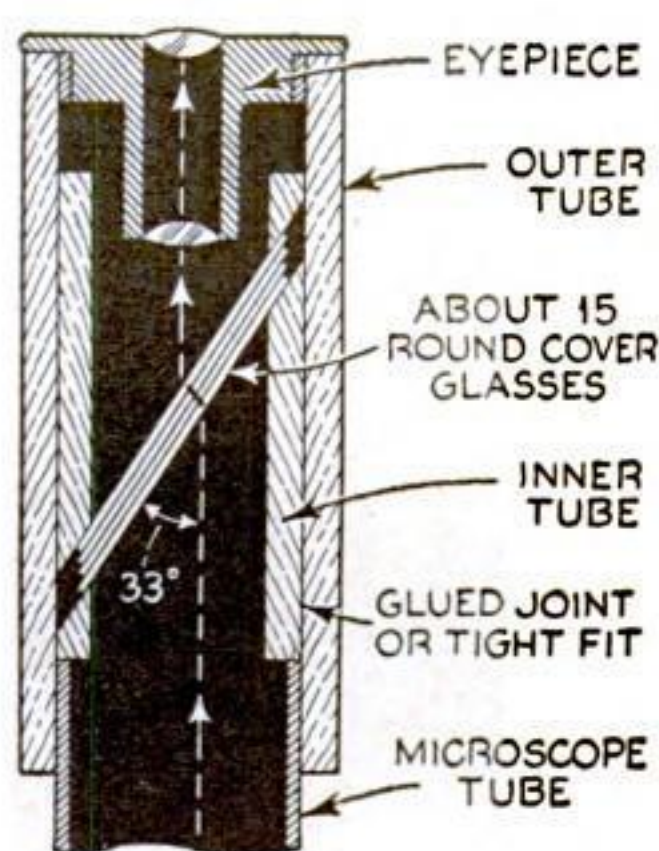
The analyzer is to be used between the upper end of the microscope tube and the eyepiece, which must be lifted out or unscrewed from its usual position. Insert the diagonally slotted inner tube so that space above it is provided for the eyepiece. There should be, below the lower section, enough space to permit the analyzer to be slipped over the microscope tube for a distance of about an inch. It may be necessary to build up the thickness of the walls of the outer tube to provide a snug fit around the tube and the eyepiece,

Finished black-mirror polarizer and, in the foreground, parts for the analyzer



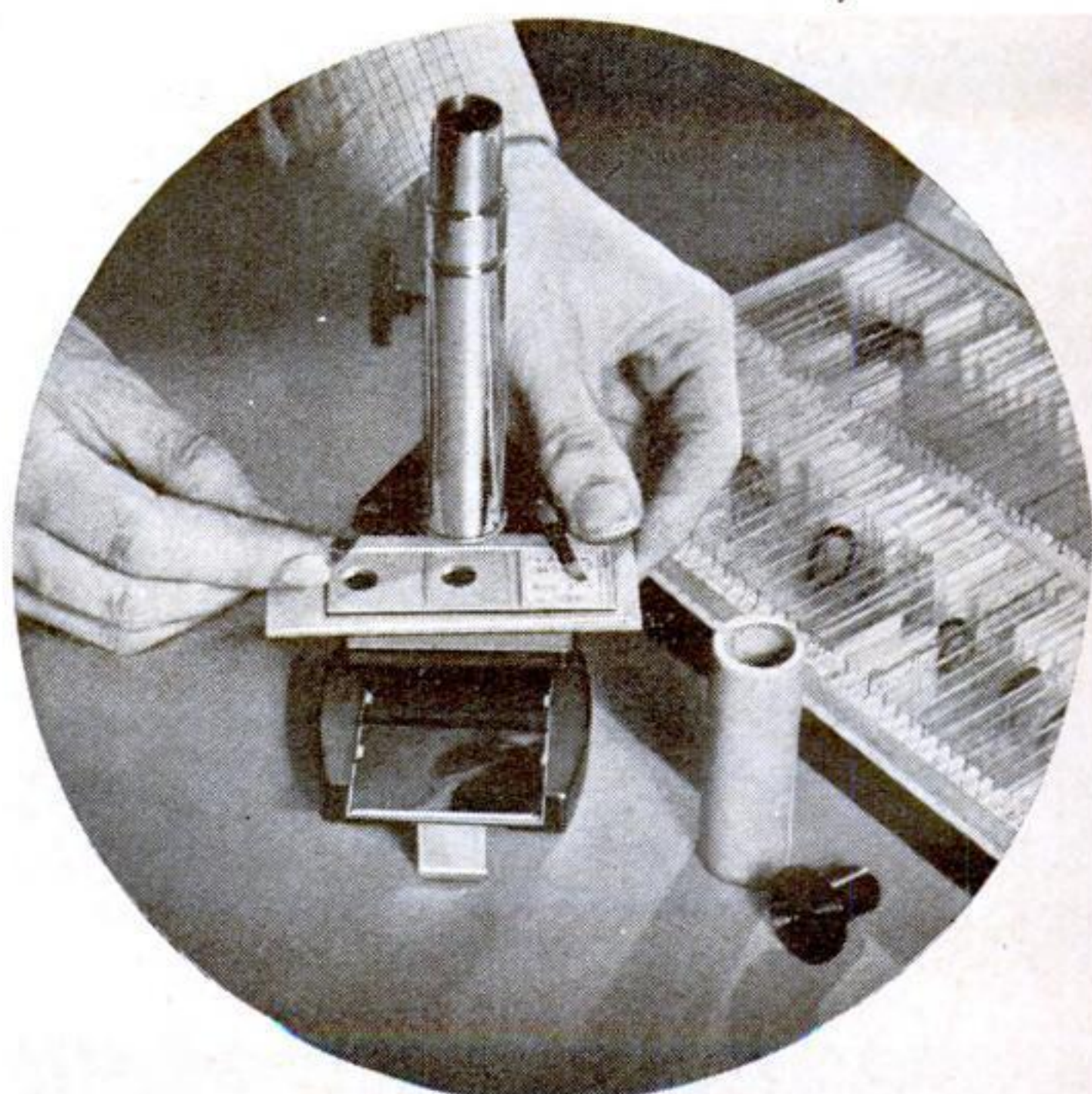
after the glass pieces and their supporting tube are in place. Paint all inner surfaces of the unit with black India ink or dull-finish lacquer (made by adding lampblack to black brushing lacquer).

Clean the cover glasses carefully, to remove every trace of scum and lint. Push one section of the diagonally cut tube into place, using a little glue, if



necessary, to hold it firmly. Next drop the cover glasses into position, and make sure that they lie flat and rest firmly against the sloping end of the inner tube. Finally insert the second half of the inner tube, pressing it firmly but not too hard against the cover glasses.

To use this polarizing outfit, remove the

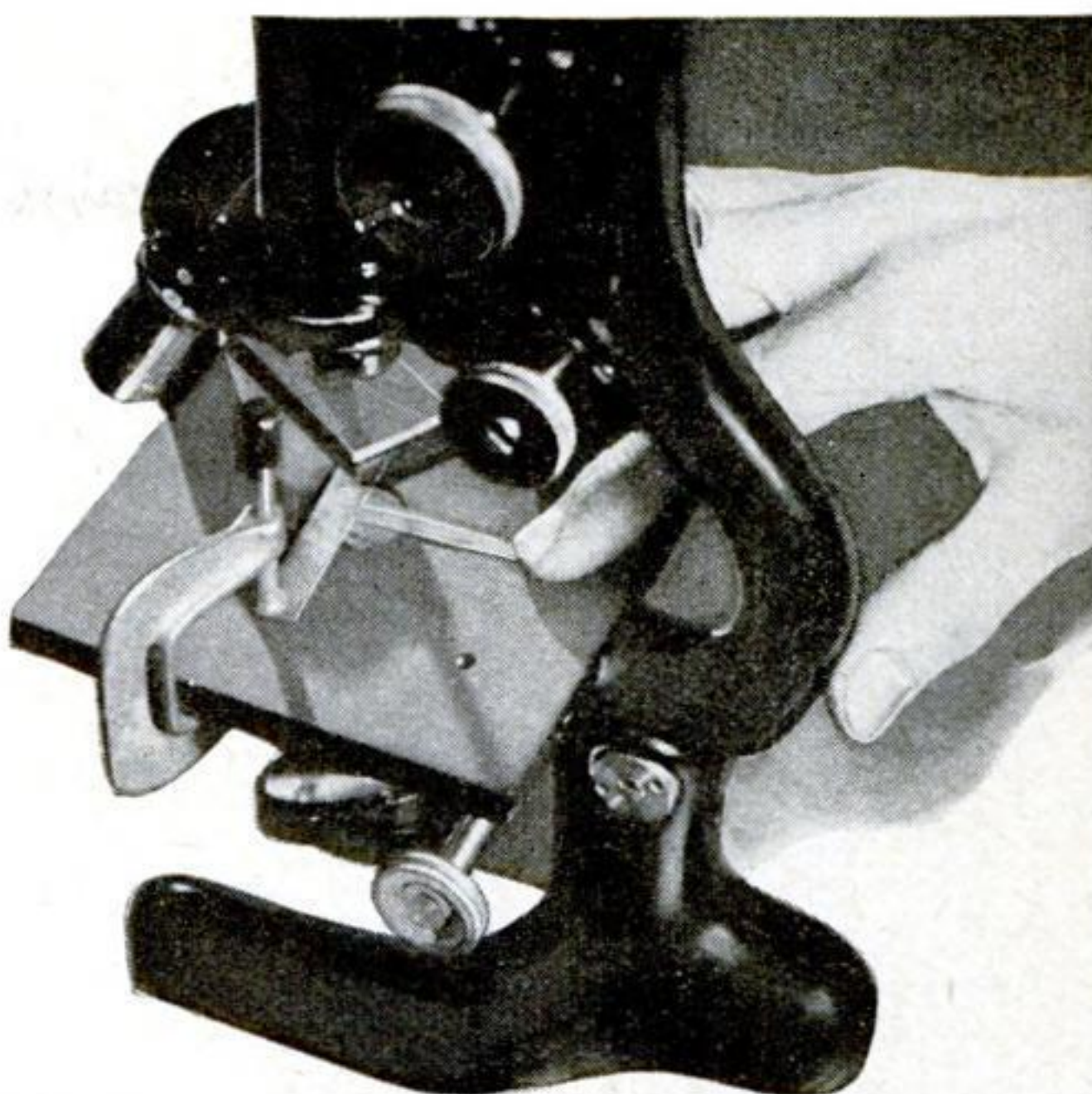


Mica plates mounted in a cardboard holder can be placed under the object slide to modify the color

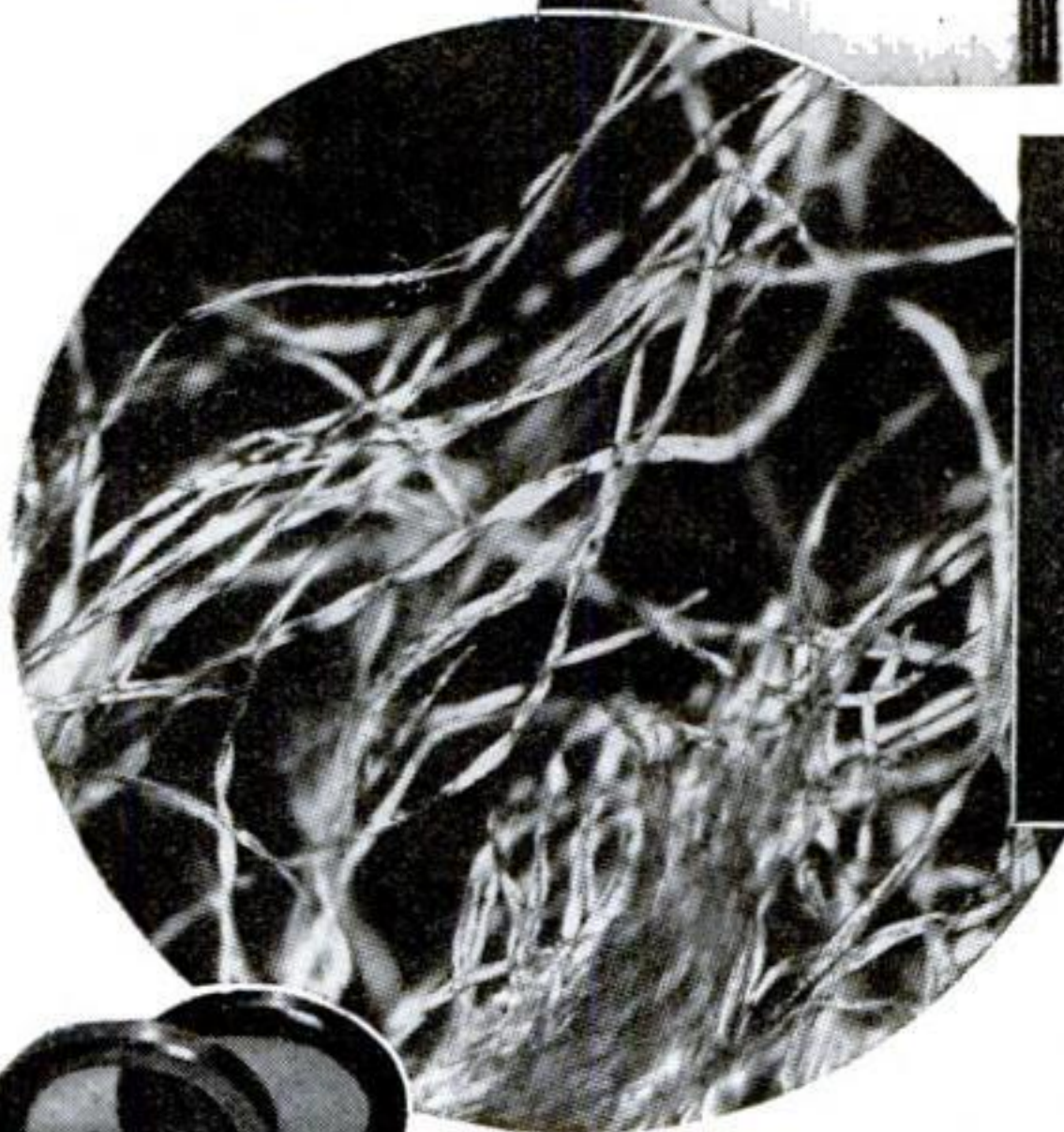
substage microscope mirror and slide the black-mirror polarizer into position. Arrange the source of light, which should be an electric lamp or other small illuminator, so that the angle between the rays of light from it and the outer black mirror is thirty-three degrees. Install the analyzer by removing the eyepiece, slipping the unit over the upper end of the tube, and dropping the eyepiece into its upper end. Look through the microscope and rotate the analyzer. The field should change from brilliance to almost complete darkness twice during a complete revolution, when no other source of light is affecting your eyes than that illuminating the polarizer.

With the field at maximum darkness, place on the microscope stage a slide bearing a few strands of cotton. These should be seen brightly lighted, against a dark field. Try a bit of crumpled cellulose film or a piece of sheet mica. You should see vivid colors, which change as you rotate the analyzer. Perhaps one of the best tests for the efficiency of your polarizing outfit is to observe potassium chlorate crystals. Place a drop of saturated potassium chlorate solution on a clean slide and let it evaporate. Cover the crystals thus produced with balsam, and add a cover glass. This gives you a permanent preparation. Seen by ordinary white light, the crystals are almost invisible; but when viewed by polarized light, with the analyzer in various positions, they give a gorgeous display of vivid colors.

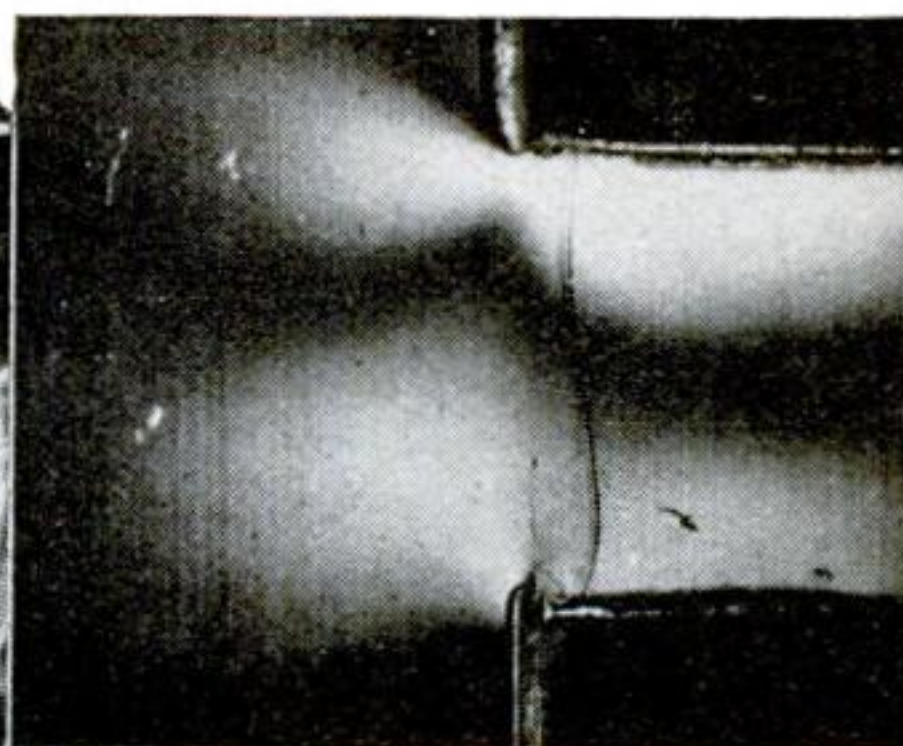
With your polarizing microscope, you can duplicate the work done by engineers in large laboratories to determine stresses in steel



A T-shaped piece of celluloid, held on the stage with clamps, is seen at left by ordinary light. Below, how polarized light reveals stresses set up when the free arm is moved from side to side

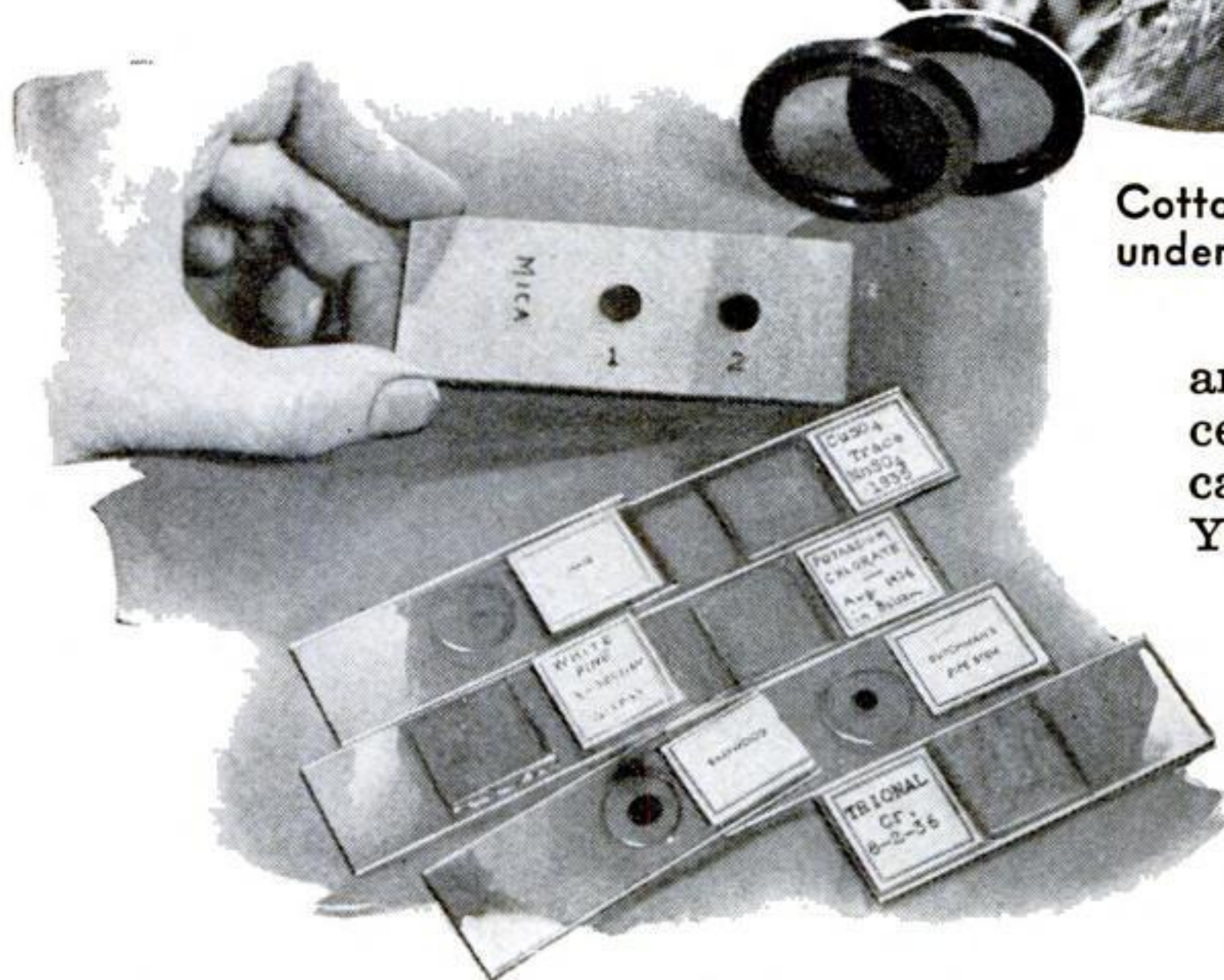


Cotton fibers in cloth under polarized light



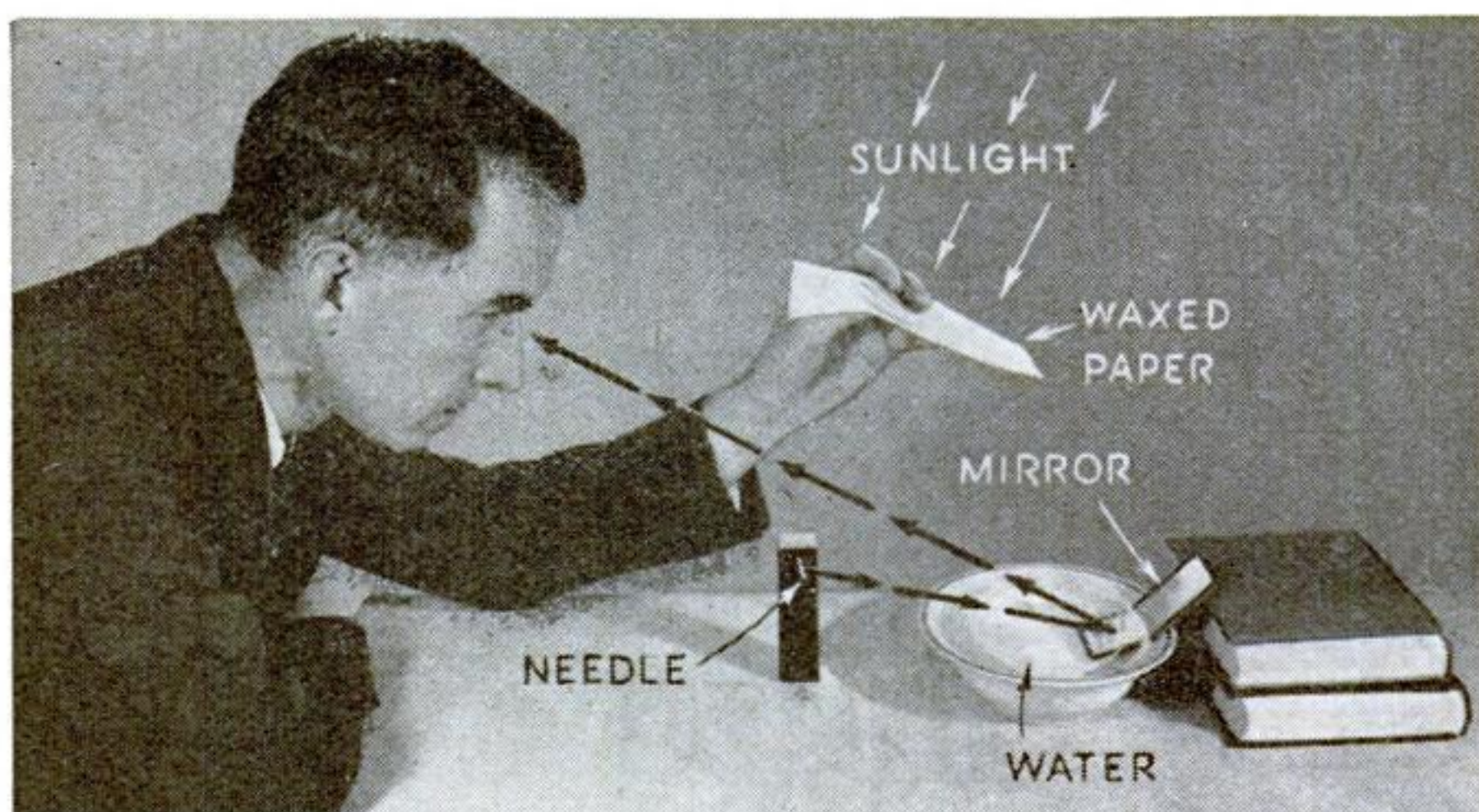
structural beams by observing strain figures produced in celluloid models. Celluloid, like glass and various other transparent materials, remains dark under the polarizing microscope, when polarizer and analyzer are crossed. However, when the celluloid is under a strain, light areas indicate the presence and extent of this condition.

You can see this action very easily with the aid of a T-shaped piece of celluloid. In making the T, cut the material cleanly and squarely with a sharp knife. Focus the microscope on the junction of the two sections of the pattern, and fasten the two ends of the cross bar of the T to the stage with small C clamps. Adjust the analyzer until the field is dark. Now, when you move the free portion of the T sidewise with your finger, (*Continued on page 242*)



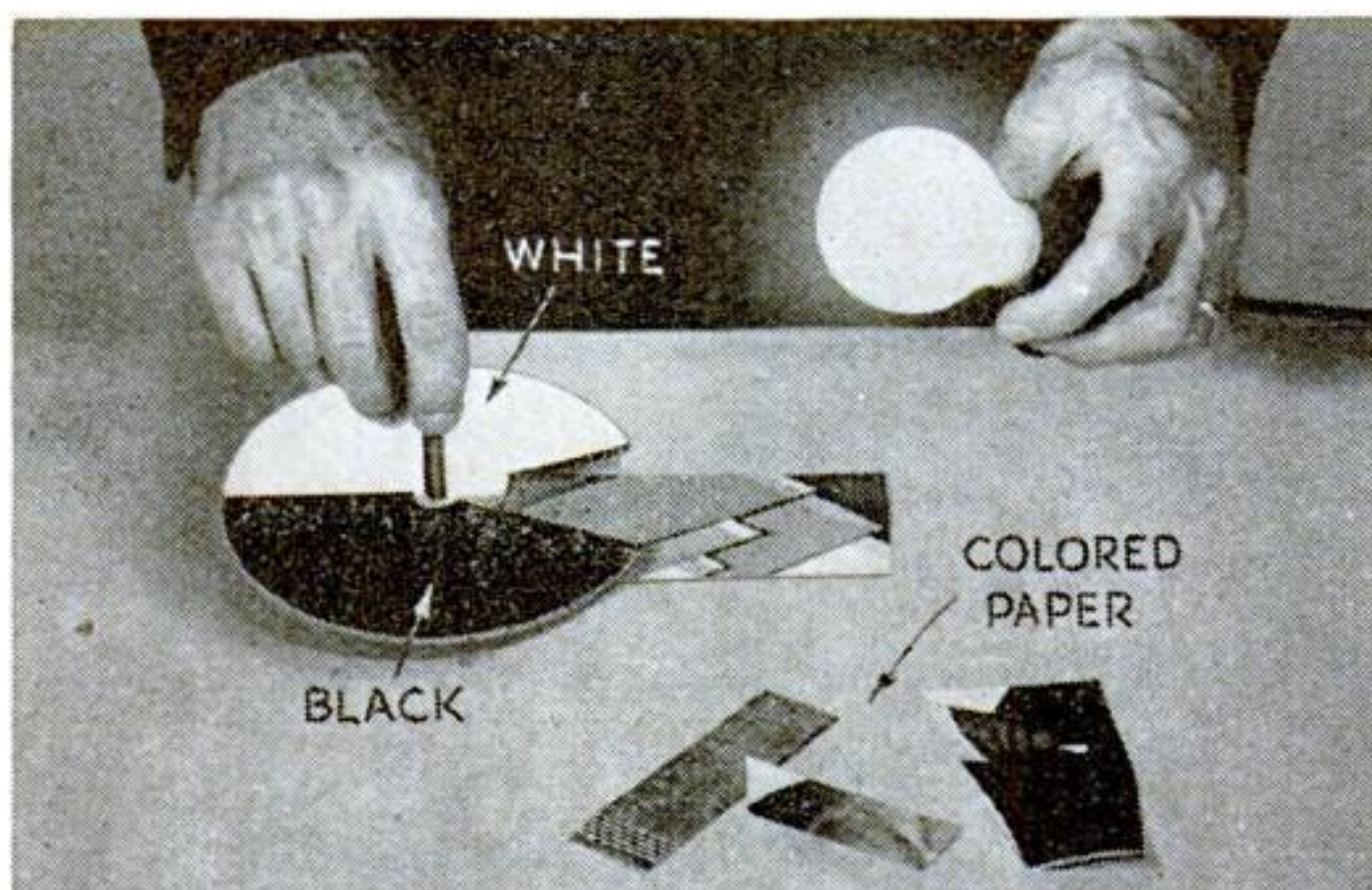
Slides of polarizing objects, holder with mica plates, and a pair of commercial sheet-type polarizing disks

Simple Stunts Prove Laws



Seeing Lines in the Sun's Spectrum

YOU can easily see the dark lines, called Fraunhofer lines, in the sun's spectrum. In direct sunlight near a window, mount a sewing needle horizontally, and partly submerge a small mirror in water. Diffuse the sunlight with waxed paper, look at the needle's image in the water, and you will see a spectrum with a dark line in the yellow region, and others less clearly defined in the green, blue, and violet. Vapors in the sun's atmosphere produce the lines by absorbing light of certain wave lengths.



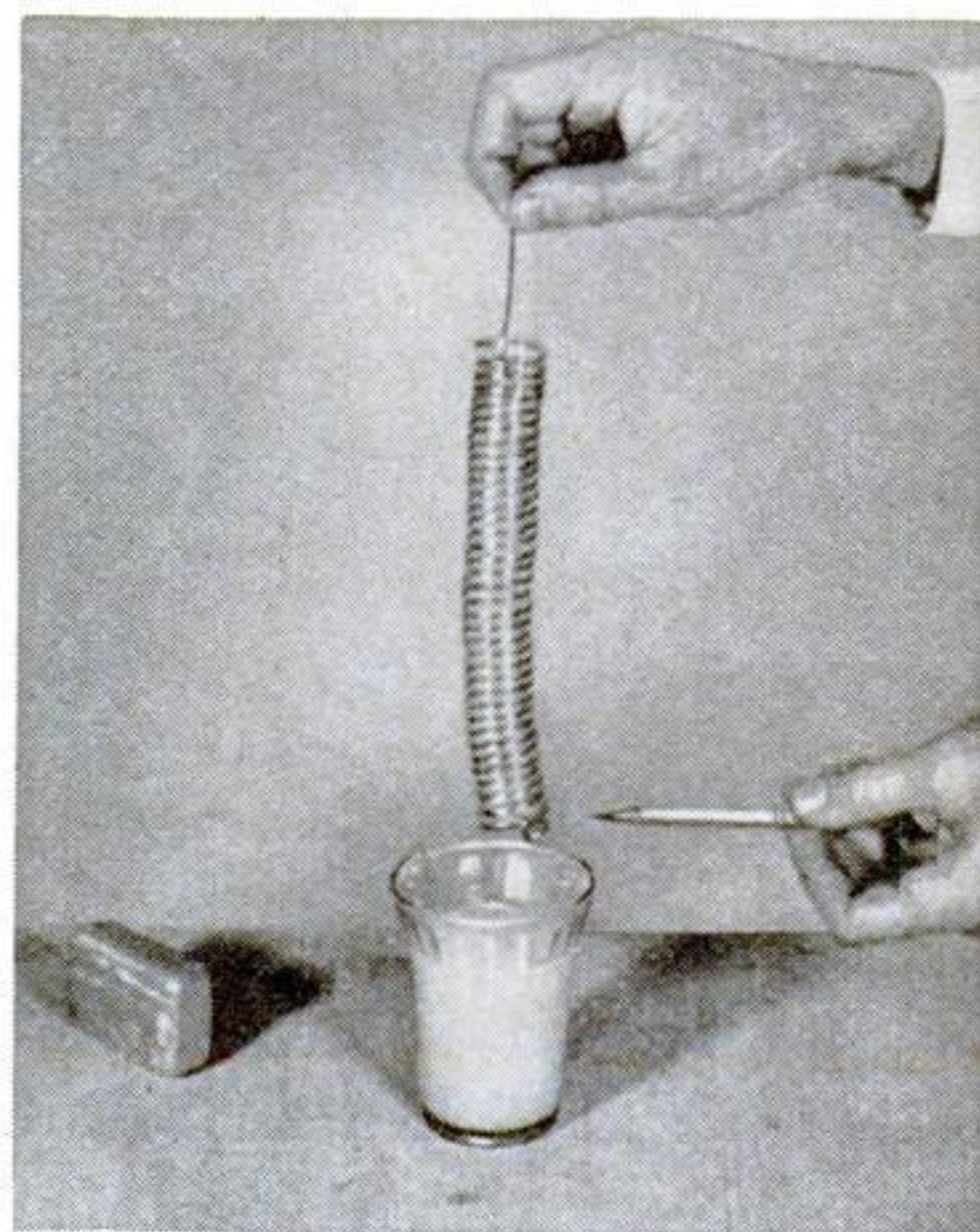
You Can't Always Believe Your Eyes

MAKE a top from a six-inch disk of white cardboard and a pencil. Cut out a forty-five-degree notch, and paste half of the cut-out piece on each side of the notch, to balance the disk. Blacken half of the disk as shown. Spin the top clockwise and look through the notch at colored pieces of paper, illuminated by a lamp close by. The colors will disappear and pale complementary hues will be seen. The reason is that fatigue lessens the eye's responsiveness to the color seen through the notch by the time the white part of the disk comes into view, and other colors that make up white light therefore make more of an impression. Spin the disk counterclockwise, and the true colors will be seen.

WITH A KITCHEN TABLE FOR YOUR LABORATORY, YOU CAN MAKE THESE SEVEN AMAZING TESTS

Soap Bubble Breaks in "Slow Motion"

TO WATCH a soap bubble break in "slow motion," make a coil by winding about ten feet of copper or iron wire around a broom handle. Loop each end of the coil around the adjoining turn, as shown, to make a complete inclosure for the soap film, leaving a bit of wire projecting from the top for a handle. Dip the coil in a weak soap solution and let it drain. In a few moments the film will break at the top, and you can watch the split-second travel of the break to the bottom. Soap bubbles break the same way, the tension of the film drawing it rapidly away from the point where the break starts. The experiment is pictured below.

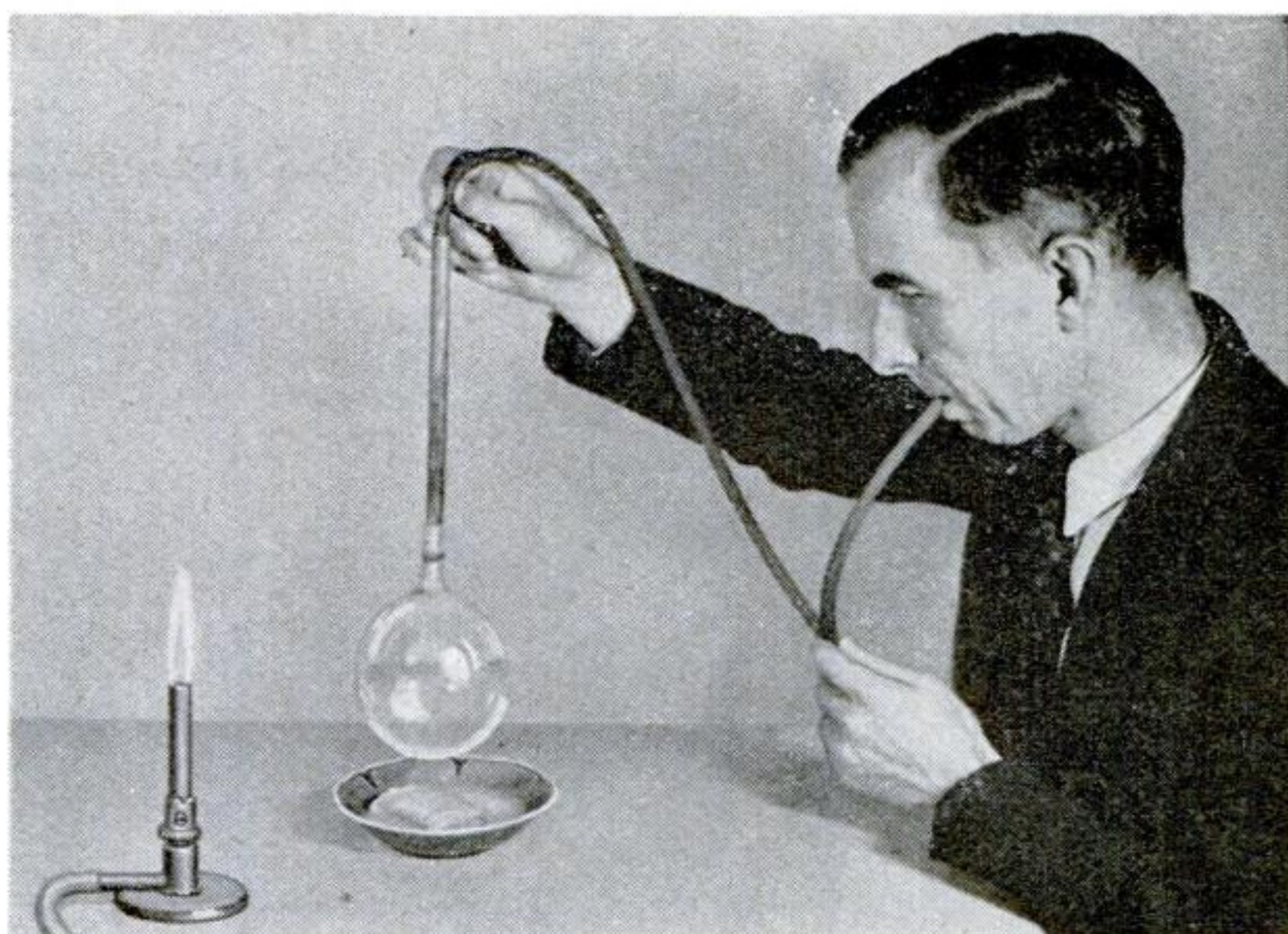


The break runs quickly down the coil

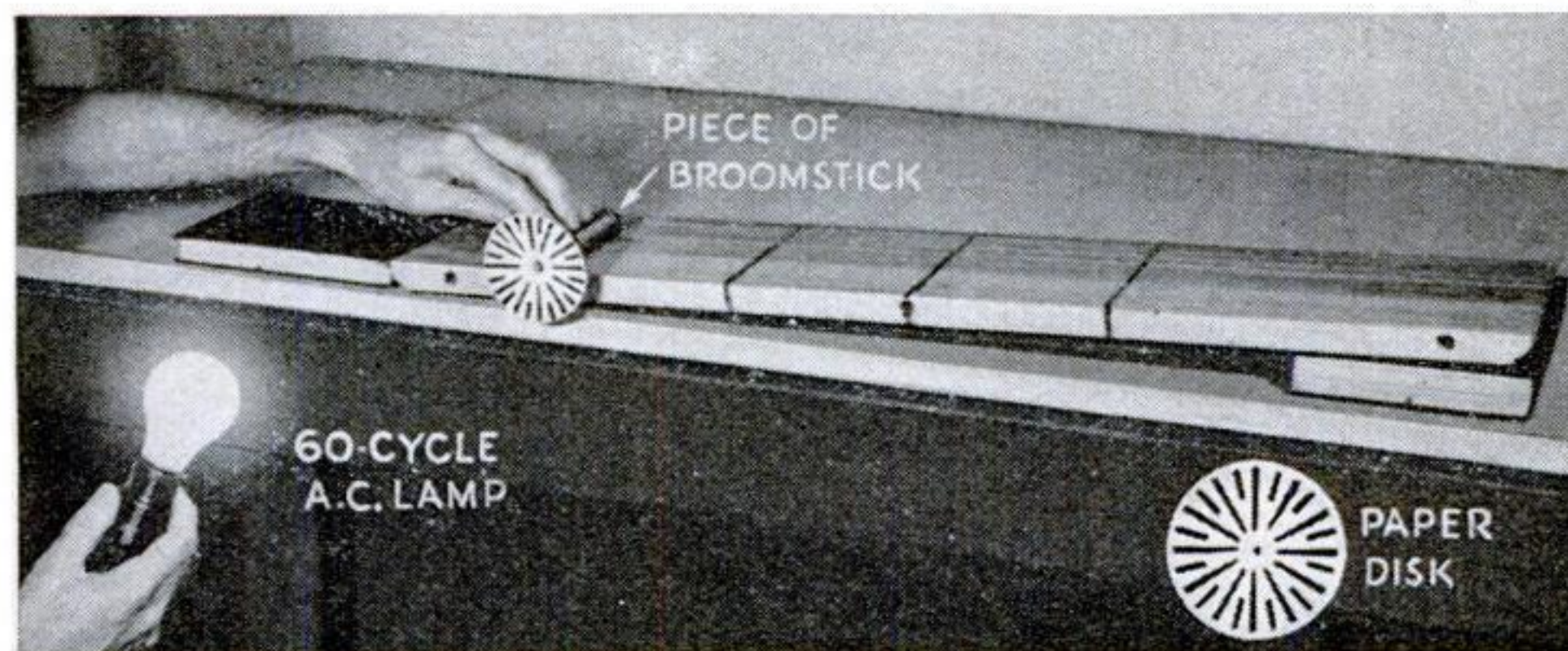
of Science

Preheated Air Makes Balloons of Bubbles

ROLL a metal tube from a sheet of ordinary tin. No soldering is needed. Wrap one end of the tube with a strip of cloth, held by a rubber band, and attach rubber tubing to the other. Warm the metal tube over a Bunsen flame or stove, dip the cloth in soapy water, shake off the excess liquid, and blow a bubble as you would with a bubble pipe. Pull the tube away when the bubble is thin enough to show red and green colors. It will rise and float like a hot-air balloon,

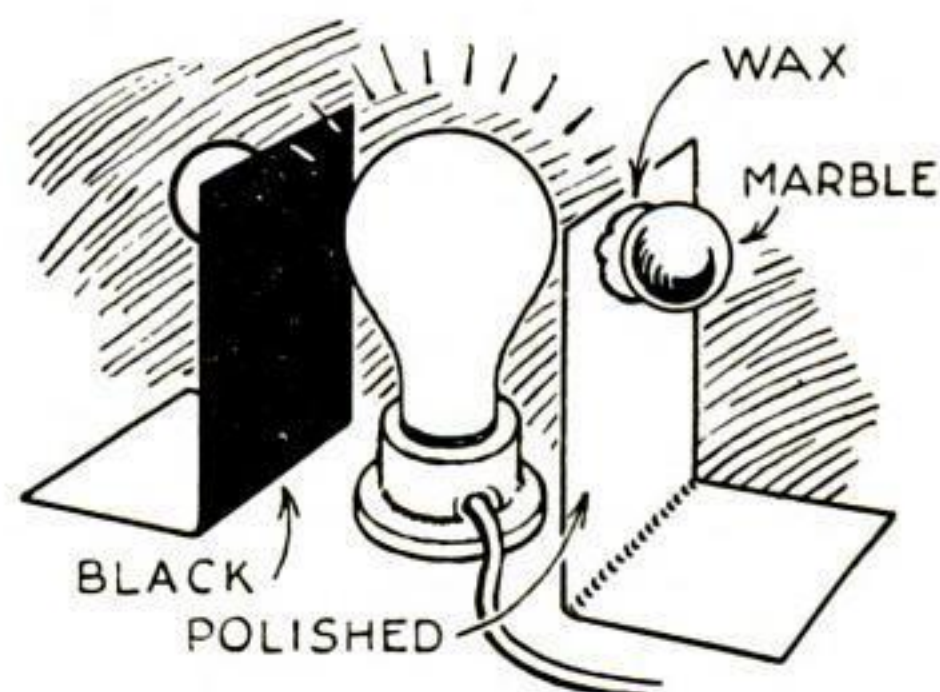


lifted by the warm air inside. Heated air was used by early balloonists before hydrogen and helium were introduced.



Rolling Disk Shows How Bodies Fall

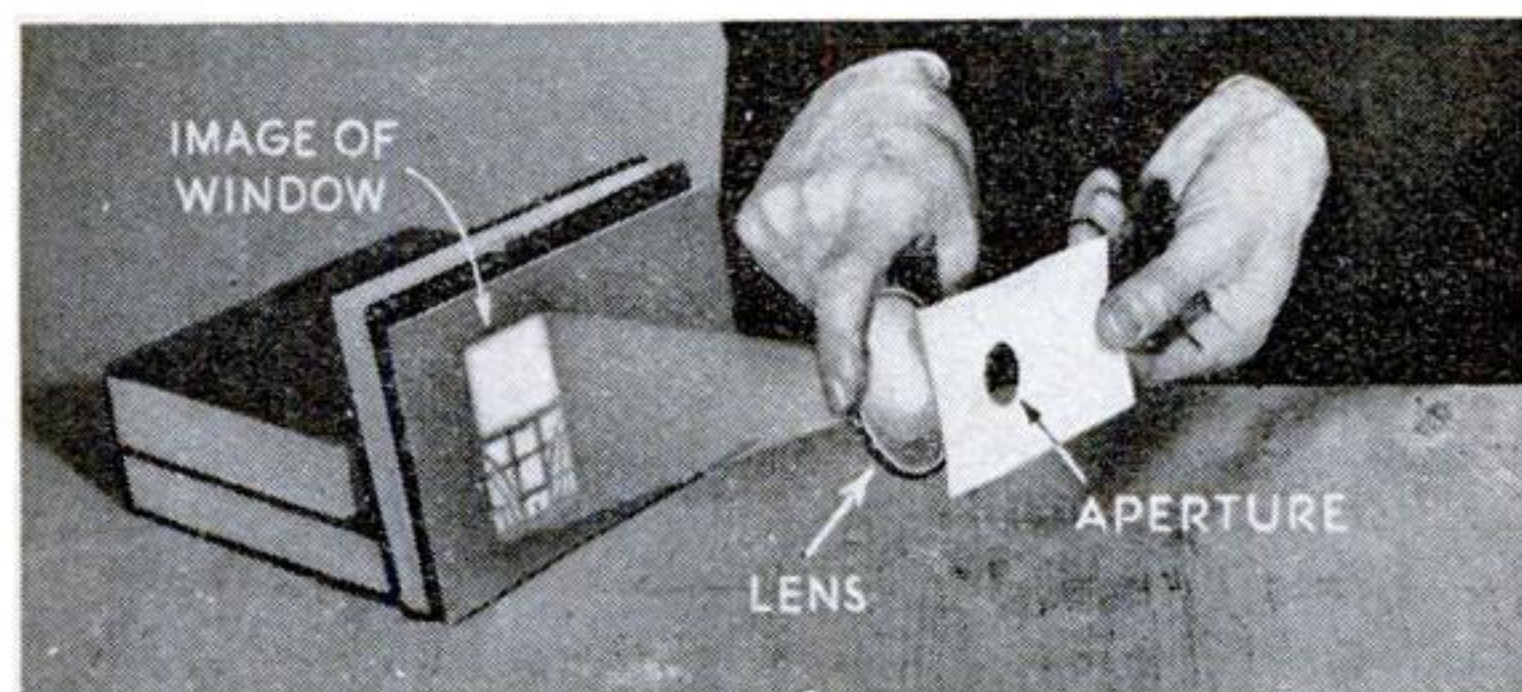
THE speed of an object that has fallen ten feet is doubled when it has fallen four times as far, or forty feet. Because objects rolling down an incline obey the same law, this is easy to demonstrate. Mark a paper disk with an outer row of twenty-four black segments and an inner row of twelve, as shown in the insert above. Tack the disk to a short piece of broomstick and let it roll down an inclined board, starting at varying distances from the bottom. Illuminate the disk with a sixty-cycle, alternating-current lamp and mark the distance when the outer row of marks on the disk appears to stand still as it reaches the bottom. Now increase the distance four times, and the inner row of marks will appear to stand still as the disk reaches the bottom.



Blackened Surface Absorbs More Heat

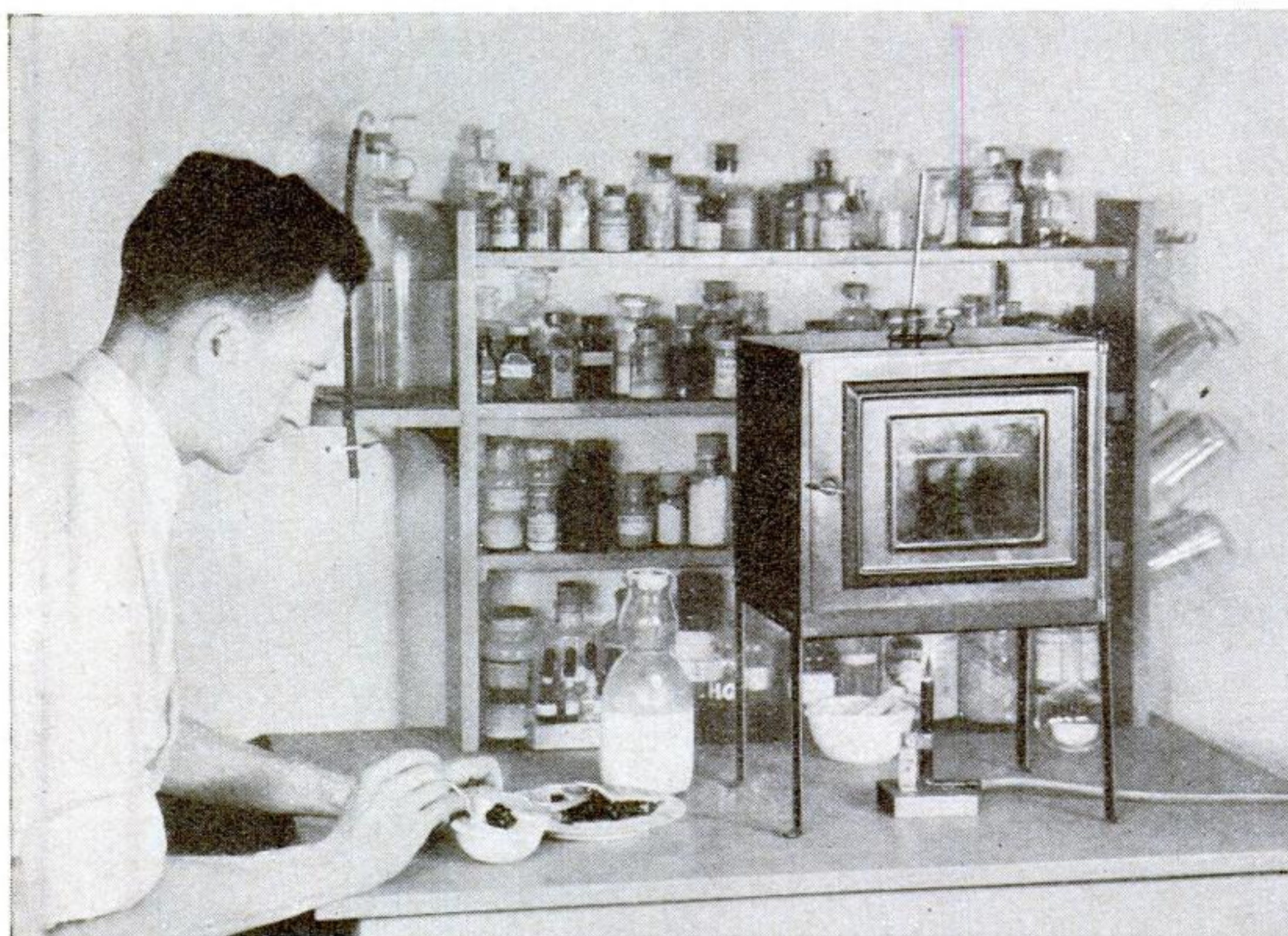
MAKE two L-shaped plates of tin and blacken one as shown. Attach a marble with paraffin to each plate and place a lighted bulb exactly midway between them. The marble will soon fall from the blackened tin as the heat melts the wax, but the marble on the shiny plate will remain much longer. Black surfaces absorb heat, polished surfaces reflect it.

Why Smaller Lens Apertures Give Sharper Photos

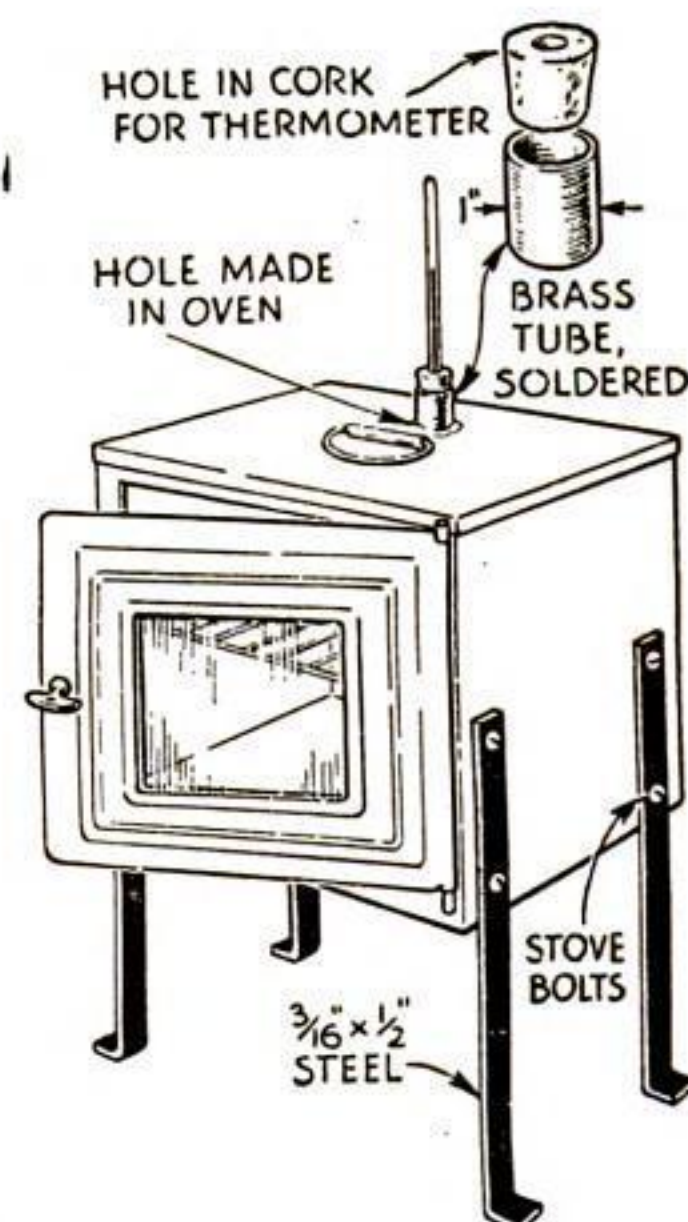


HOLD a lens so that it focuses the image of a window upon white paper. Then place a card with a small hole in front of the lens. Objects beyond the window, such as trees, will now be sharply focused, too, because the rays of light are confined to the center of the lens. This illustrates the use of camera iris diaphragms. By "increasing depth of focus," as it is called, sharper photos are obtained.

How To Analyze



Blueberries being placed in a crucible for drying in the test for manganese



DRYING OVEN. A metal kitchen oven, makes a handy piece of equipment for the laboratory

By **RAYMOND B. WAILES**

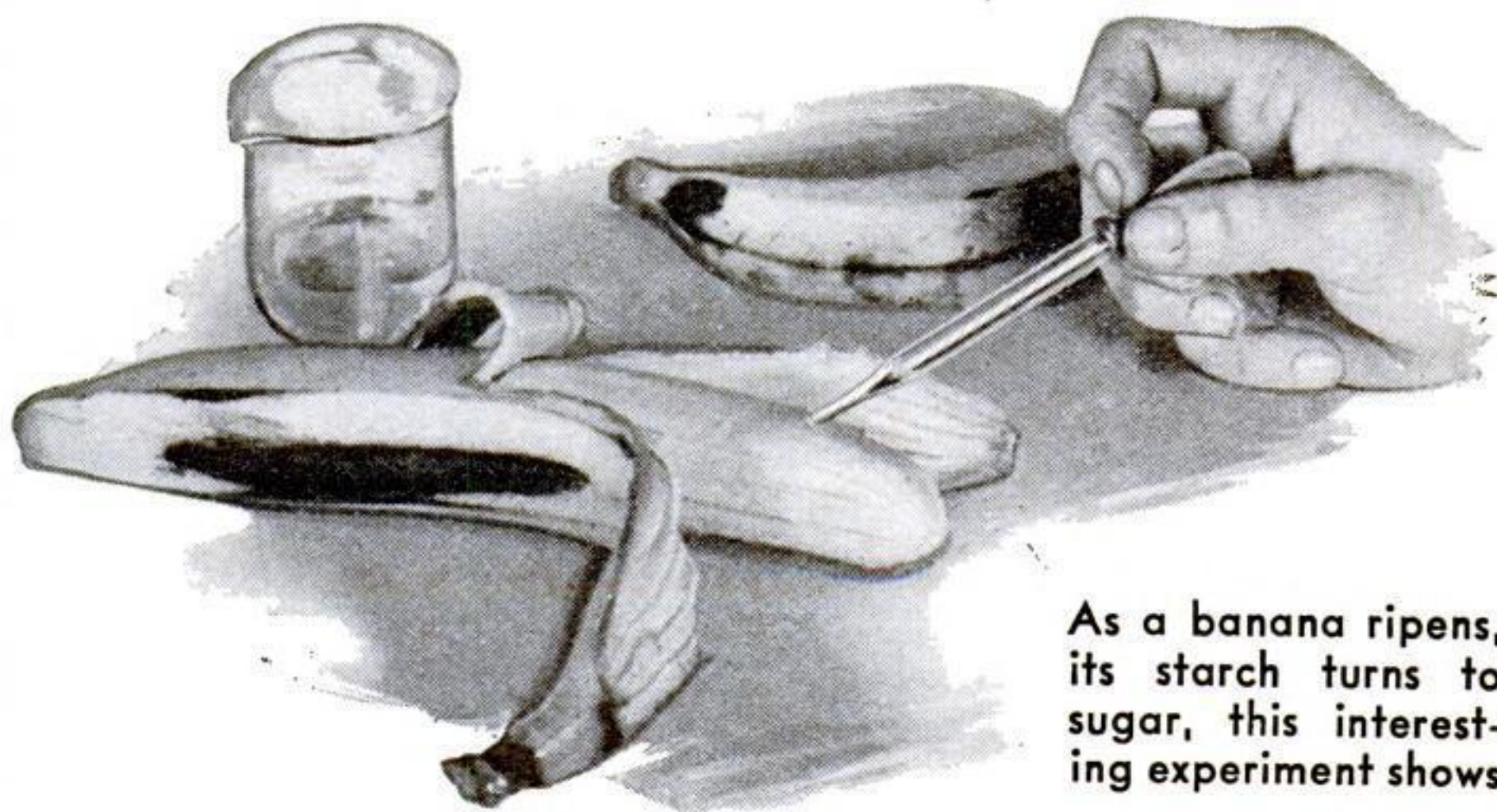
WHEN mothers urge their children, "Drink milk and you will have pearly teeth," or, "Eat your spinach and grow up to be a big boy," they are paying an unconscious tribute to the chemist. He was the research worker who found that spinach contains iron, and that milk supplies great quantities of the element calcium, which enters so largely into the building of bones and teeth. Likewise, we owe to chemists the discovery that sea foods hold more iodine than other foods, and many other facts of vital importance about diet and its relation to health.

Would you like to try your hand at analyzing foods, just as other chemists have done, to find out what is in them? It may surprise you to know that in your own home laboratory you can prove that oysters contain copper, and detect the none-too-common element manganese in a slice of blueberry pie. You can find the iron in spinach, the calcium in milk; and not only can you investigate the process by which nature turns an unripe banana into a ripe

one, but you can even imitate it yourself.

Suppose you start your adventures in foodland by prospecting for manganese among the berries from a piece of blueberry pie. How this is done illustrates a standard procedure that you can use for detecting metals and other elements in almost any foodstuff. For analysis, the material needs to be concentrated. To get rid of the organic matter, it is "ashed," or heated until only a small amount of ash remains behind. If the food to be analyzed is pulpy, squashy, or liquid, it should also be dried, before ashing, to prevent loss by spattering.

You can easily make a drying oven for this preliminary process. It will also come in handy for drying chemical precipitates



As a banana ripens, its starch turns to sugar, this interesting experiment shows

Foods IN YOUR HOME LABORATORY

and glassware that has just been washed. From the kitchen counter of a department store, or from a mail-order house, you can obtain a metal oven about a foot square for less than a dollar. It is intended to be placed on the burner of a stove, but it makes a fine laboratory drier, too, when it is fitted with four iron legs. You can make these from pieces of iron of about $\frac{3}{16}$ " by $\frac{1}{2}$ " size, drilled to be bolted to the sides of the oven. The lower ends of the legs may be bent out to form small feet. An all-glass thermometer, of the type used in chemical laboratories, completes the drier. A neat way to attach the thermometer is to punch a $\frac{3}{4}$ " hole in the top of the oven, solder a short length of metal tubing to the rim of the hole, and insert a one-hole cork carrying the thermometer. A Bunsen burner heats the drier from beneath. The legs should be high enough so that the inner cone of the Bunsen flame does not strike the bottom of the oven.

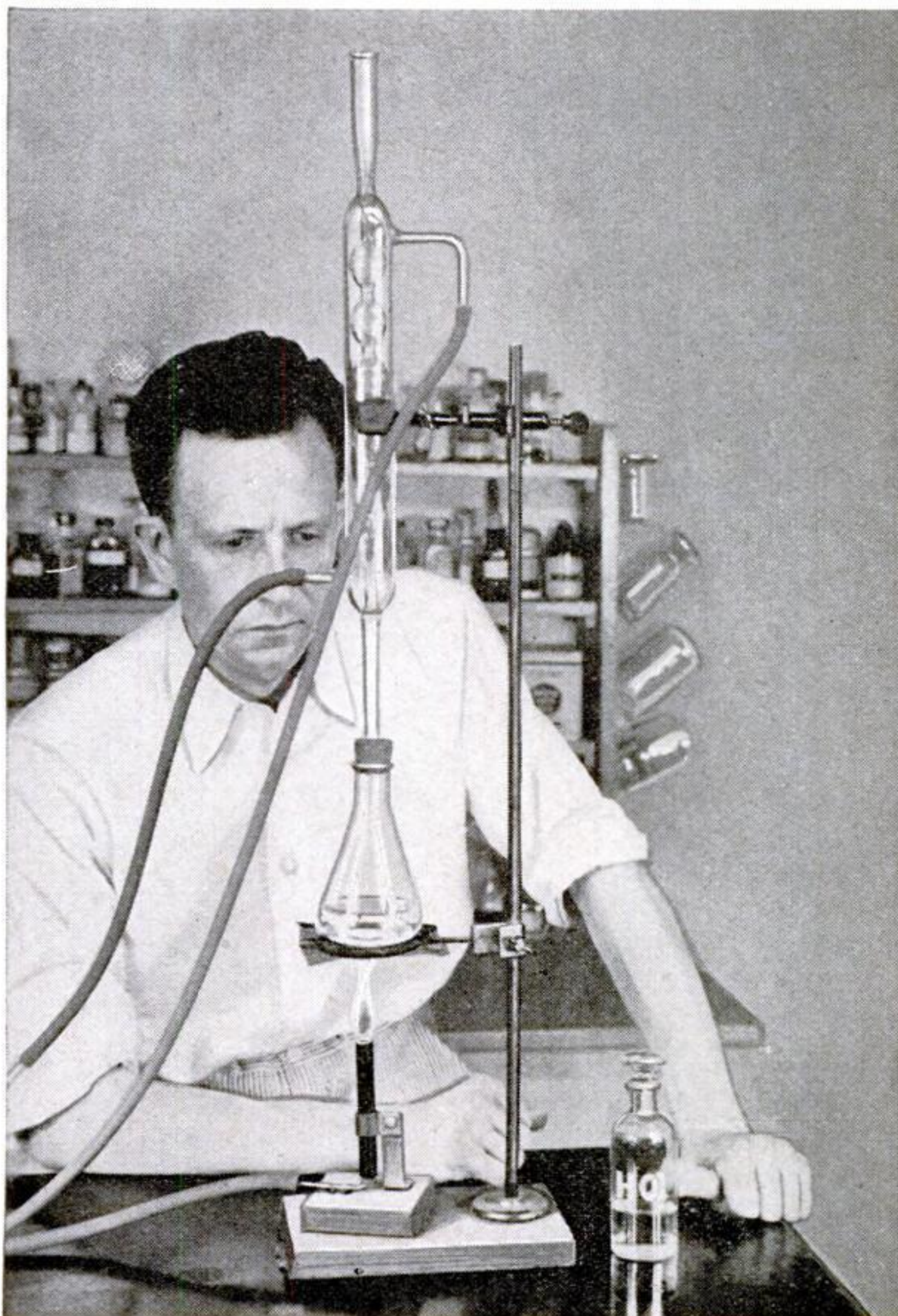
Place several tablespoonfuls of cooked or uncooked blueberries, in a porcelain evaporating dish, on the shelf of the oven. Heat the drier with the burner, keeping it at a temperature a few degrees above the boiling point of water. About 105 degrees centigrade, or roughly 220 degrees Fahrenheit, is a good temperature for drying these and most food products.

When most of the moisture has been driven off, as shown by the feathery and dusty appearance of the residue, take the dish of berries from the oven and place it on a wire triangle over a Bunsen flame for the ashing process. The use of a porcelain evaporating dish for the preliminary drying makes it unnecessary to transfer the contents to another vessel for this strong heating. Heat the material with the full flame of the Bunsen burner until all charred pieces are converted to a light-colored ash. This will require from a few minutes to several hours, depending upon the material being ashed. If unsavory odors are given off during ashing, simply pick up the Bunsen burner and direct its flame straight down upon the material in the dish. This will burn the odorous vapors and destroy them as fast as they are distilled from the contents of the dish. When

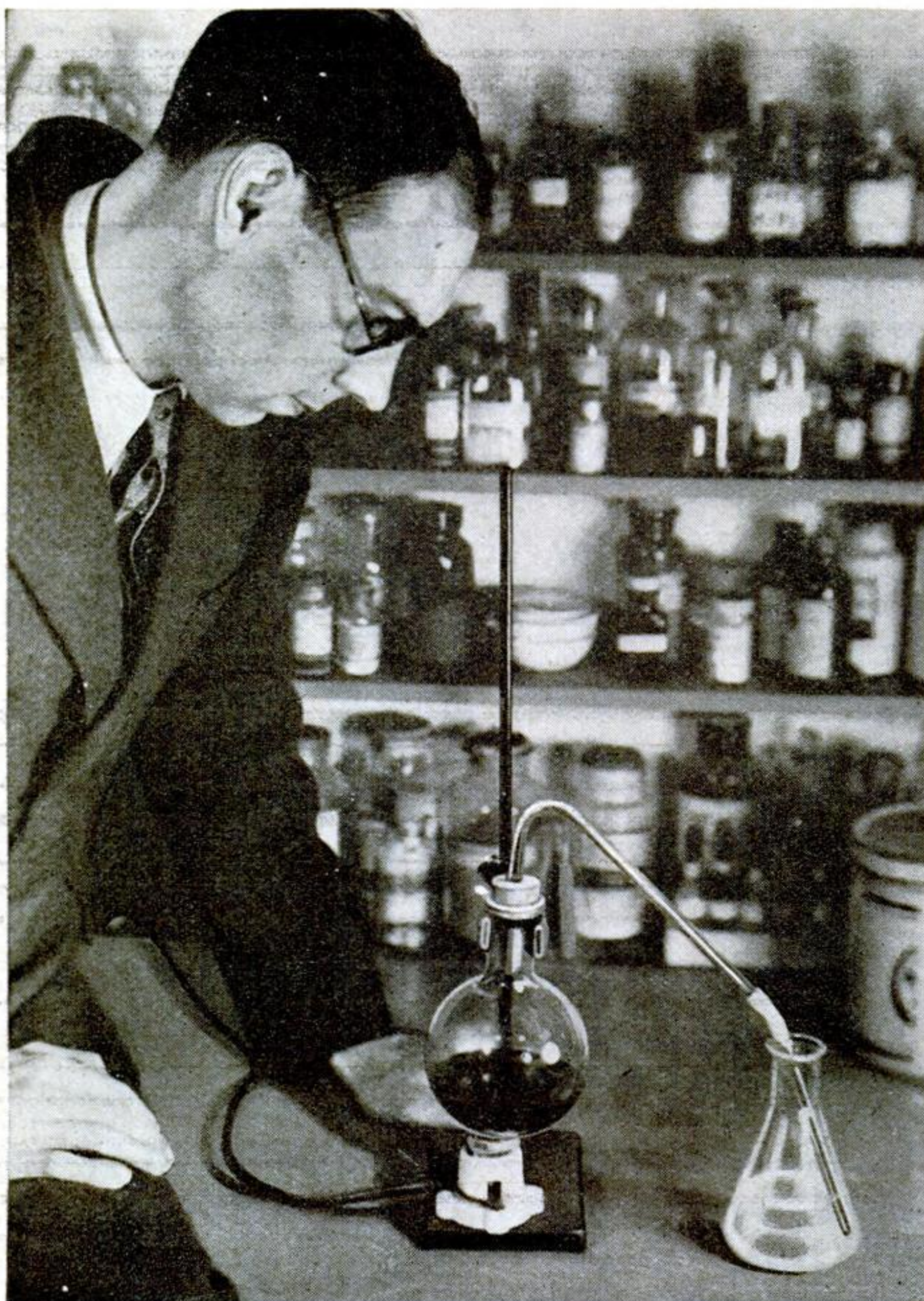
ashing is completed, only a small amount of ash will remain. However, it will contain all the metals originally present in the compound, and most of the other elements, too. If not to be tested immediately, it may be kept in a stoppered bottle for future experiments.

To analyze any such ash, it is dissolved in a suitable acid—usually a mixture of strong nitric acid or sulphuric acid with about four times its volume of water. Suppose you dissolve the blueberry ash, by gentle heating, in about ten cubic centimeters (three teaspoonfuls) of nitric acid of this strength.

Filter the resulting solution and place several cubic centimeters of it in a test tube. Add about one gram, or a scant quarter teaspoonful, of lead peroxide, and several cubic centimeters of strong nitric acid. Boil the mixture, and let it settle. If manganese



You can imitate nature's work in turning starch into sugar by the use of a reflux condenser, as illustrated above



That coffee holds carbon dioxide gas is proved by boiling ground coffee in water and passing the resulting vapor through limewater

is present, the solution will be colored violet. The hue is produced by the formation of permanganic acid, and is definite proof that the blueberries contained manganese.

A test such as this, which aims simply to establish whether or not there is *any* manganese in blueberries, is called qualitative analysis. It is a highly important part of standard chemical procedure. To go a step farther and find out *how much* manganese is contained in blueberries, you would need to resort to another type of test known as quantitative analysis. This, also, is a method of great importance in professional chemical work, but requires a balance capable of weighing with extreme precision, and other expensive apparatus not usually available in an amateur laboratory. Probably you will be satisfied to take the word of those who have made such elaborate and painstaking analyses, that you actually consume about two

milligrams, or seven one-millionths of an ounce, of manganese when you eat a fair-sized slice of blueberry pie.

That oysters contain copper is demonstrated as easily. Use three or four oysters for your test. Dry them, ash them, dissolve the ash in nitric or sulphuric acid, and filter the solution, just as you did with the blueberries. Now add ammonium hydroxide solution to the filtrate—the liquid that has passed through the filter—until the mixture is alkaline. It has reached this point when a drop of it turns red litmus paper blue. Let the precipitate settle. If the clear upper part of the liquid is colored a deep azure blue, copper is present. The same test will reveal the presence of copper in mushrooms, currants, and calf's liver.

To detect the iron in spinach, dry and ash it in the same fashion. Dissolve some of the ash in nitric acid, which serves better than sulphuric acid for the iron test. Filter the solution, and add to the filtrate a drop or two of a solution of thiocyanate of ammonium, of potassium, or of sodium. These compounds are also sometimes called sulphocyanides. Whichever of the three is added, the solution will turn a deep-red color if

iron is present.

The ash of beans, oysters, and, particularly, pork liver, will also show the presence of iron when this test is applied. Liver of all kinds seems to be a veritable mine of metals that animal bodies contain, especially copper and iron.

Calcium and phosphorus are easy to find in milk. Evaporate about half a pint of milk in your drying oven, or directly over the Bunsen flame. Reduce the residue to ash, and dissolve the ash in nitric acid. Filter the solution. To several cubic centimeters of the filtrate, add an equal volume of strong nitric acid, and then several cubic centimeters of a strong solution of ammonium molybdate. Warm the mixture slightly, and let it stand. If phosphorus is present, a yellow precipitate will form.

To test milk for calcium, proceed exactly as before, up to and including the filtering of



DID YOU KNOW THAT OYSTERS CONTAIN COPPER? THIS AND OTHER

the solution of the ash. Now make the filtrate neutral to litmus paper by adding ammonium hydroxide very gradually, a drop at a time, so that you will not overshoot the mark. Finally add a solution of ammonium oxalate, or of sodium oxalate, and warm. A white precipitate of calcium oxalate indicates that calcium was present in the milk. To make sure that any white precipitate you see in this test is calcium oxalate and not some other substance, add a drop or two of acid to the test tube. Calcium oxalate will dissolve in the acid.

Now you can see why milk aids in building bones and teeth, which consist largely of calcium phosphate—a compound of the elements calcium and phosphorus that milk abundantly contains.

No less a mystery than the peculiar richness of blueberries in manganese, or of oysters in copper, is the queer affinity of ground coffee for carbon dioxide gas. To show that coffee holds this vapor, you have only to boil a tablespoonful of coffee in a flask half filled with water. The flask should be fitted with a one-hole stopper and a bent outlet tube dipping into a solution of clear, filtered limewater, so that any gas boiled out of the coffee must pass through the solution. Soon the bubbles coming from your chemical coffee brew will turn the limewater milky. The carbon dioxide from the coffee has reacted with the calcium hydroxide of the limewater, forming a white precipitate of calcium carbonate. You can make the limewater for this test by dissolving ordinary lime in water and filtering; either slaked or unslaked lime will do.

Why do black, ripened bananas taste better than the more attractive-looking bananas whose firmness and solid yellow or green-tinted color show they have not yet ripened? There is an interesting chemical answer. In ripening, the starch of the banana turns into sugar, as you can easily demonstrate.

Make a weak solution of iodine, by mixing a drop or two of tincture of iodine with two drops of water. When this solution is applied to any material containing starch, it will form a bluish-black spot. You can

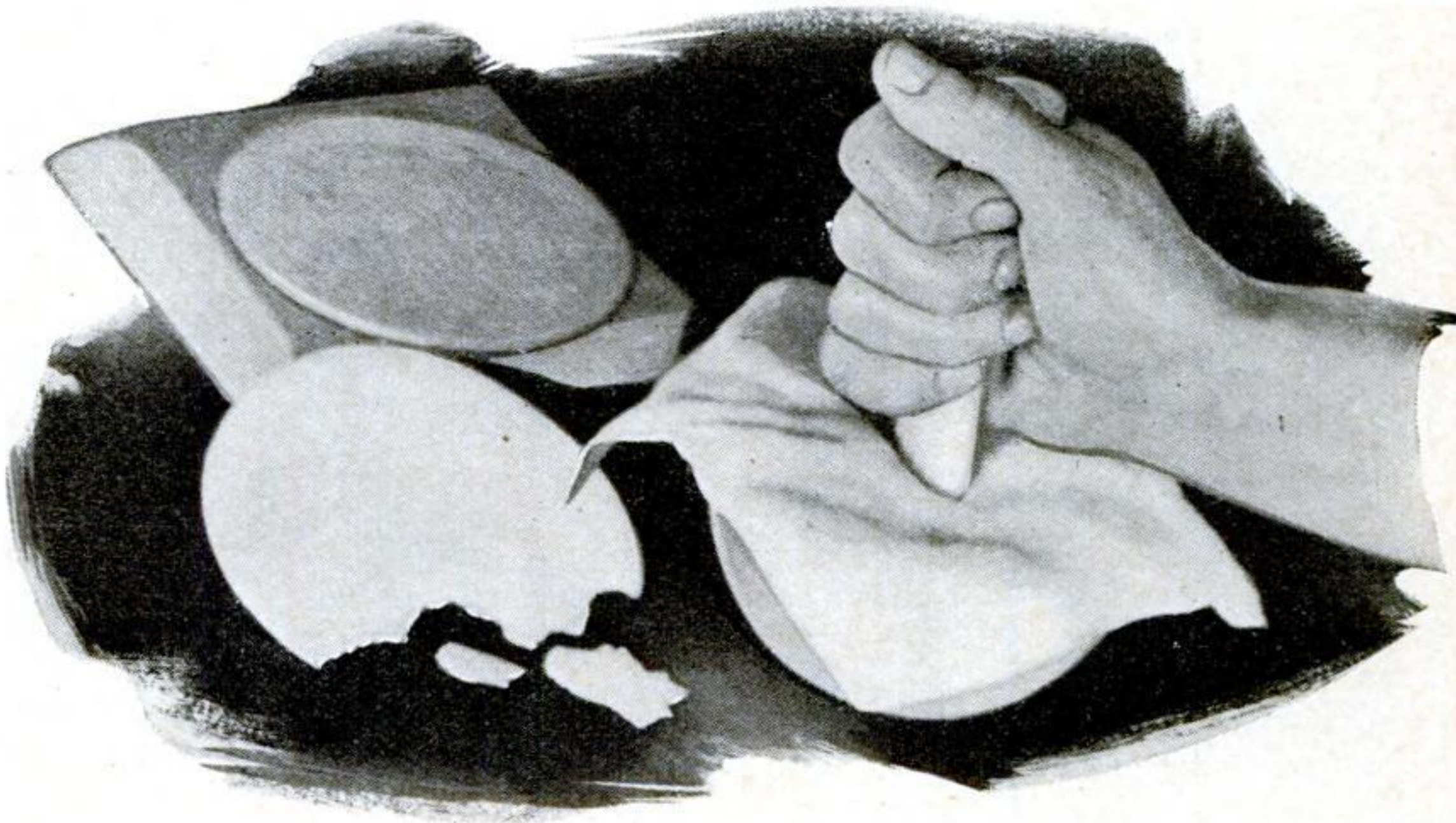
confirm this, if you like, by touching some of the solution to the freshly cut surface of a piece of potato, which is practically all starch. Now apply some of the same reagent to the edible part of an unripe banana. Again you will observe the bluish-black discoloration, showing that starch is present. Try the iodine solution on a ripe banana, however, and no discoloration will be produced, for nature's chemistry has converted practically all the starch into sugar.

Would you like to imitate nature? You can turn starch into sugar yourself. Take about half a gram (or a tenth of a teaspoonful) of corn starch and shake it in a flask with about a hundred cubic centimeters (or half a glassful) of water. Add two cubic centimeters—nearly half a teaspoonful—of strong hydrochloric acid, or its equivalent in a weaker solution of the same acid.

If you have a reflux condenser, and running water in your laboratory, attach the condenser to the flask and let water run through it while you boil the flask's contents. If not, you can improvise an effective substitute by fitting a glass tube about two feet long and half an inch in diameter in a vertical position above the flask. This serves as an air-cooled reflux condenser. The purpose of "refluxing" is to prevent loss of liquid from the flask while it is heated and allowed to digest, or act upon, the starch. Any escaping vapor is condensed, and the recovered liquid drips back into the flask.

After fifteen minutes or more of boiling, draw off about five cubic centimeters of the liquid in the flask. Test it for starch—after neutralizing it with a bit of some carbonate—by adding a dilute solution of iodine. No bluish-black color (*Continued on page 244*)

Turning paper into sugar. Bits of filter paper are being ground in a mortar with strong sulphuric acid. A cloth around the pestle protects the hands

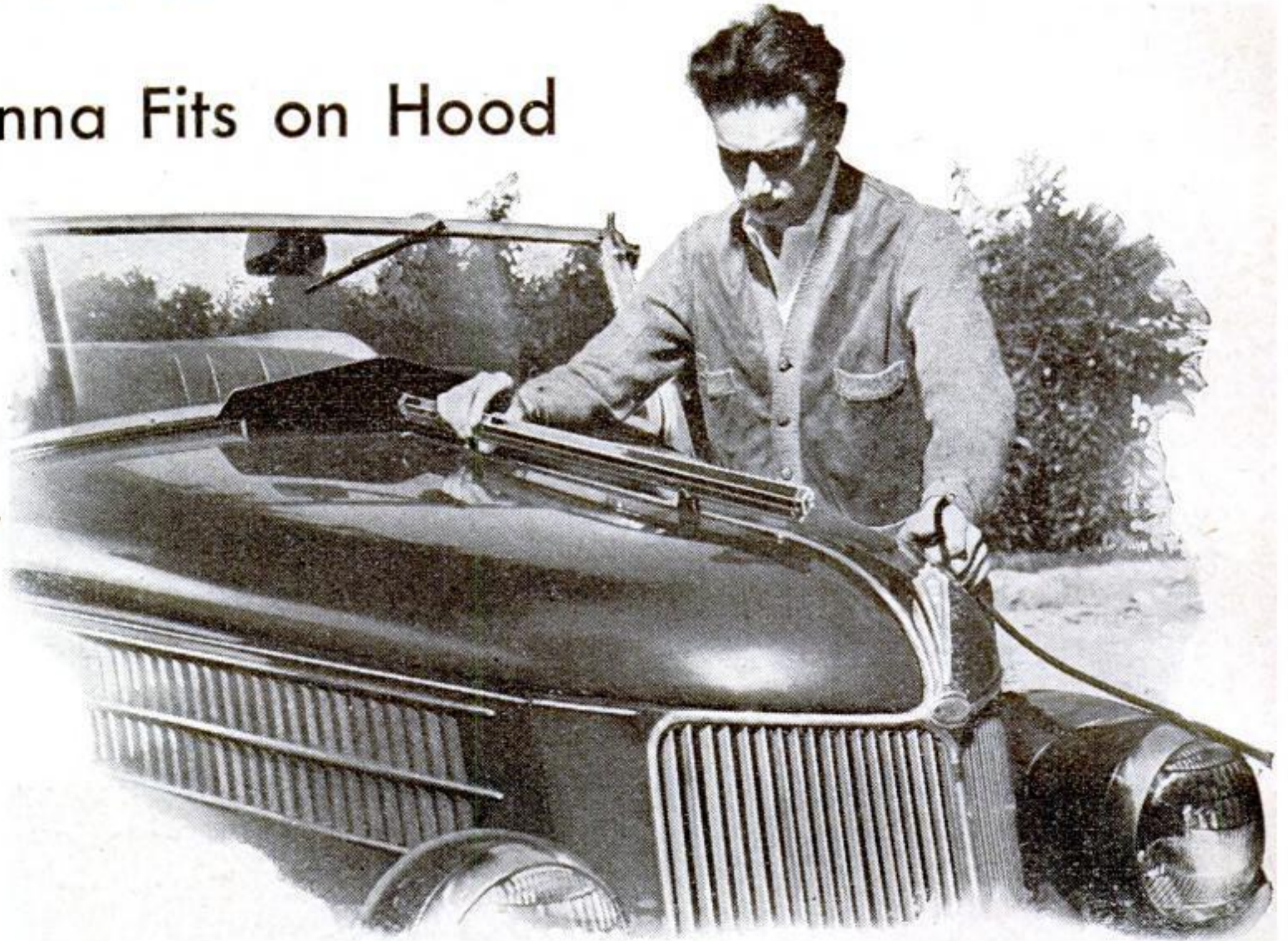


AMAZING FACTS ARE REVEALED BY TESTS YOU CAN EASILY MAKE ●

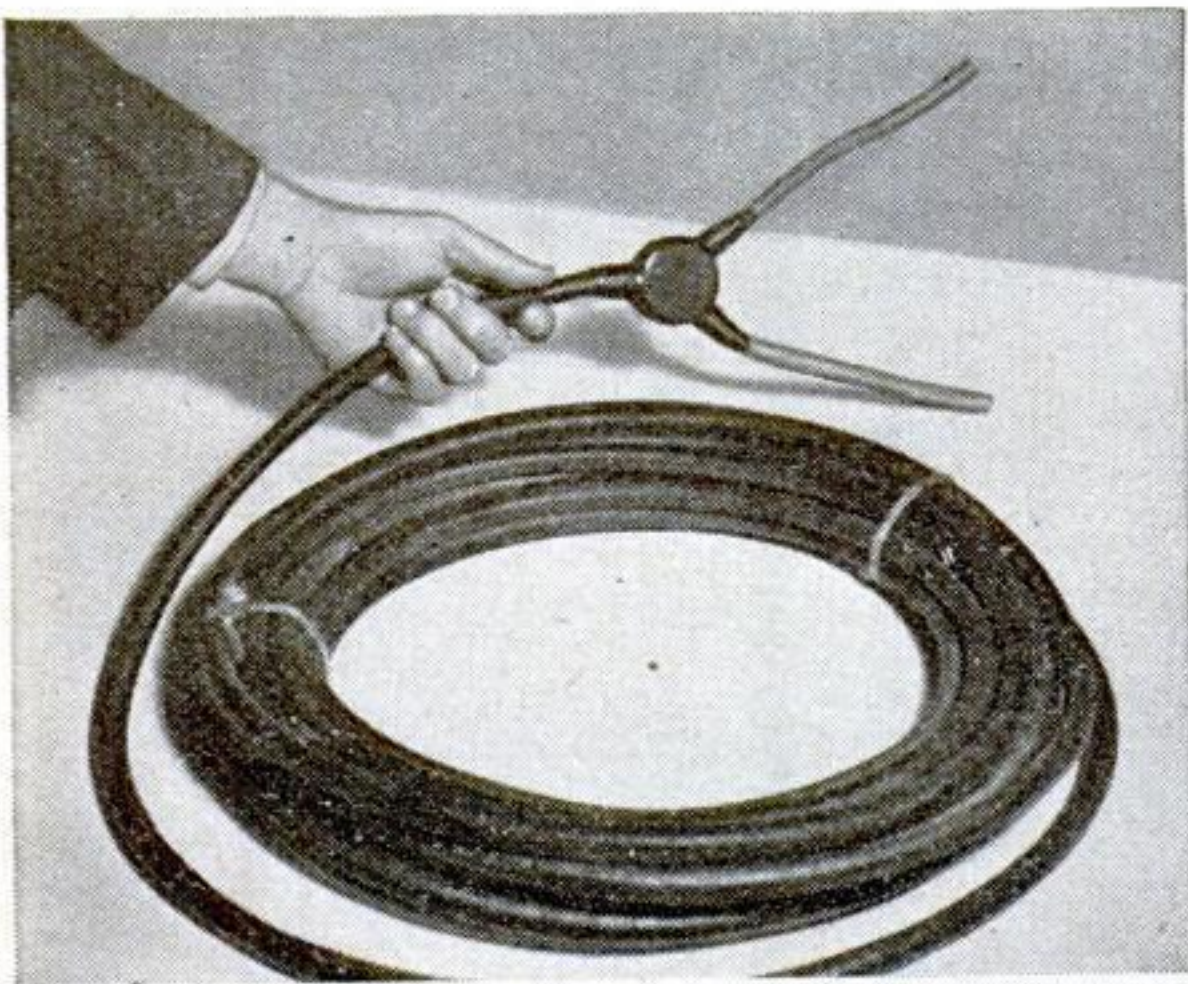
SEVEN BRAND-NEW IDEAS For the Radio Fan

Automobile Antenna Fits on Hood

AVAILABLE in various sizes to fit any make of car, a new streamline radio antenna is designed to be mounted on the engine hood. Because it is well shielded by the car's metal fenders and hood, the unit is said to reduce the interference from ignition noises and static generated by the tires to a minimum. A specially designed lead-in cable is supplied with the antenna.



Running along the top of the engine hood, the radio antenna not only blends in with the car's lines, but reduces static

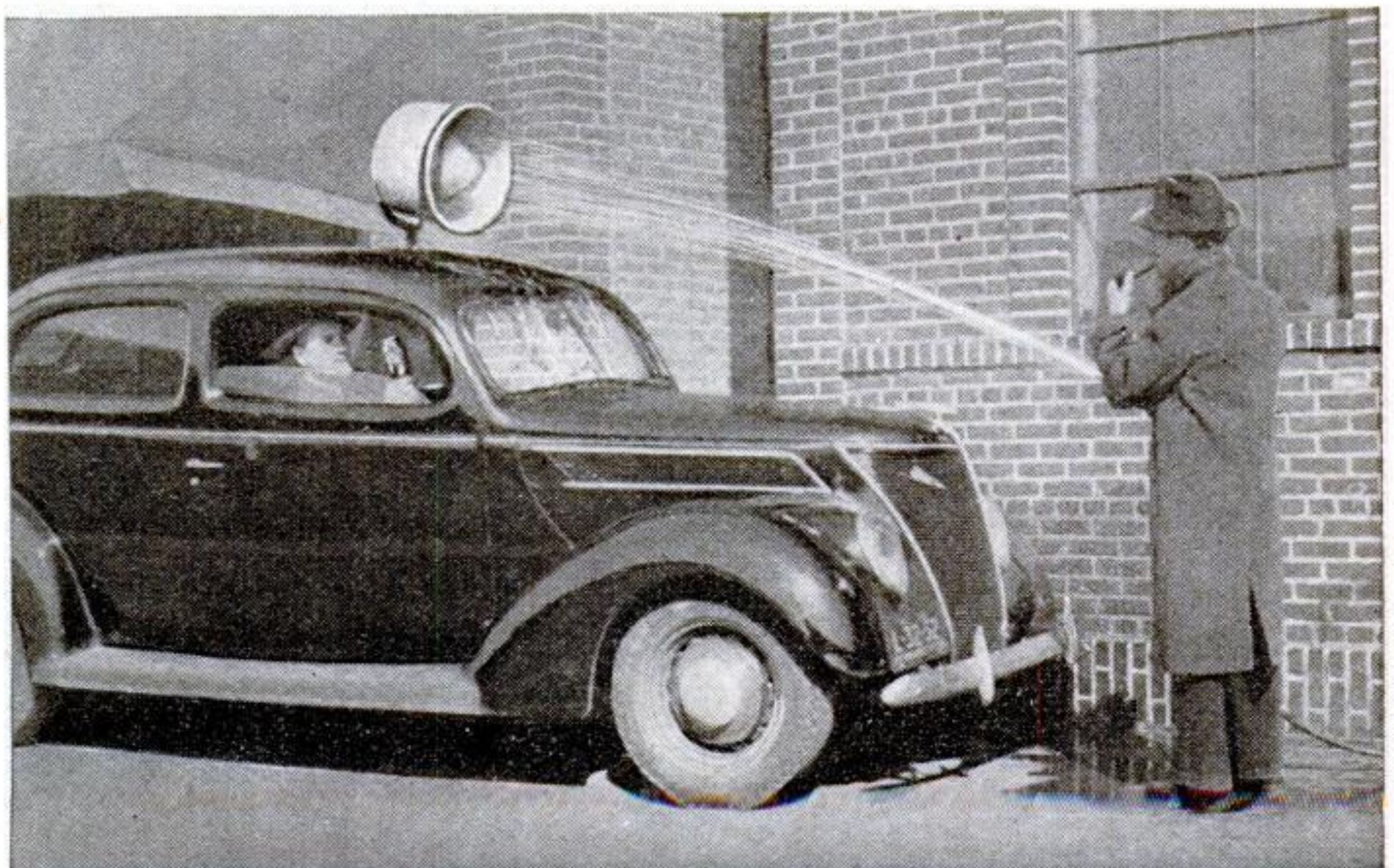


Two-in-One Aerial Feeder Cuts Transmitter Losses

BY ELIMINATING the power losses that often occur in the feeder leading from a transmitter to its antenna, a new concentric cable now makes it possible for amateurs to run their stations more efficiently. Entirely flexible and waterproof, the new twin-cable feeder shown in the illustration at the left consists of two wires, one within the other.

Speaker for Car Roof Is Waterproof

WATERPROOF and sturdy, an outdoor loudspeaker recently placed on the market for police cars and advertising cars has an all-aluminum horn, and is designed to throw a directional sound beam over a long distance. The horn is fifteen and a half inches in diameter, and only twelve inches deep. Mounted on a car roof, it can be turned in any direction desired by means of a handle attached to a shaft that extends inside the car.



Even a stream of water from a hose will not injure this speaker



Portable Generator Is Run By Car's Rear Wheel

MOUNTED on a car's rear bumper and connected by belt to a special pulley clamped to the right-rear wheel, a new alternating-current generator provides a dependable power supply for portable radio transmitters and public-address equipment. It can be operated

with the car stationary or in motion. For stationary use, it is only necessary to jack up the car's rear wheel, as shown in the photograph above. The unit takes but a few minutes to install, and no special tools are required to put it in operation.

Novel Mike Does Triple Duty

SIMPLY twisting a control knob in the base of a new crystal microphone makes it sensitive to sounds from a single direction, from opposite directions, or from all sides. It is particularly useful in public address work.

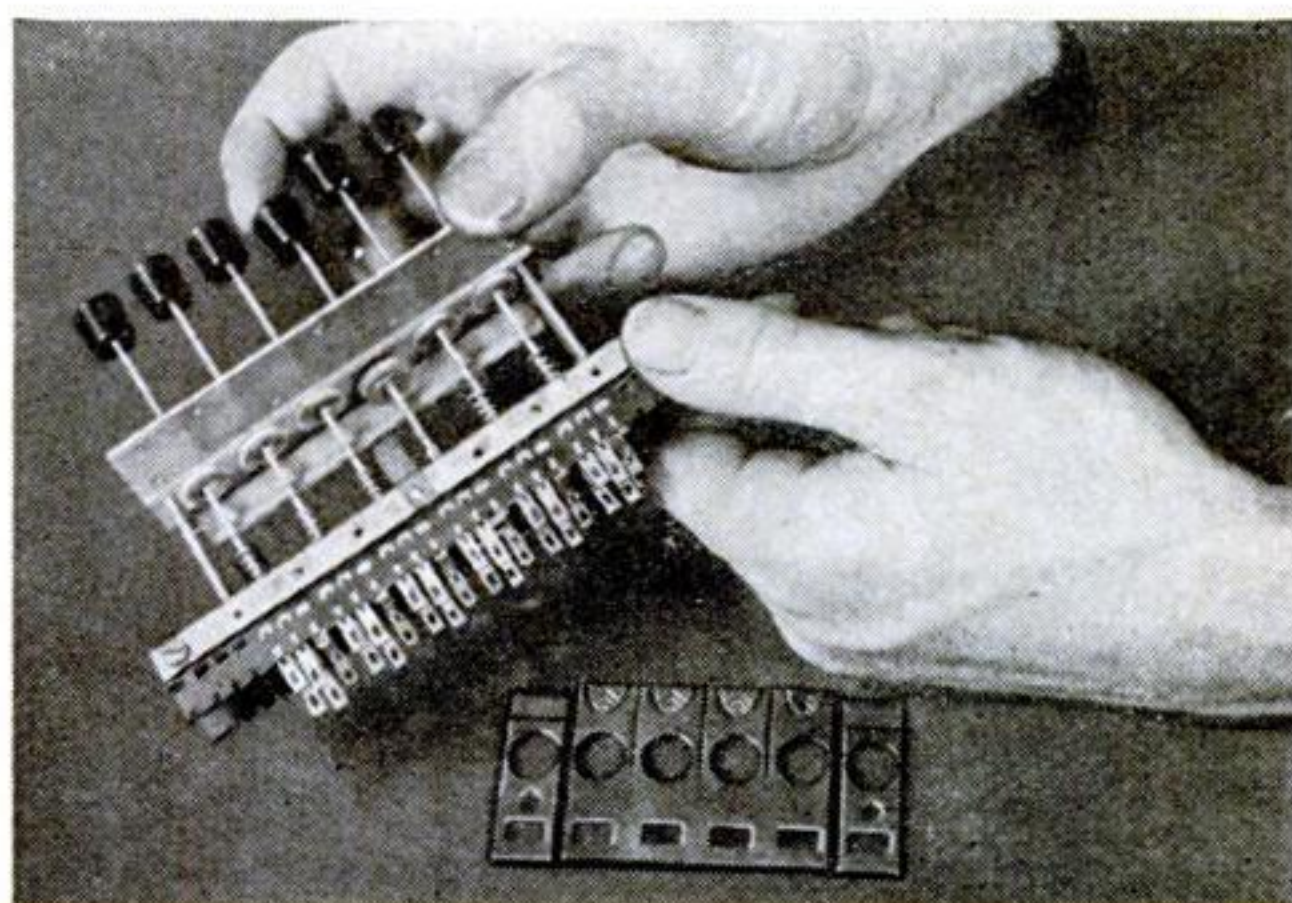
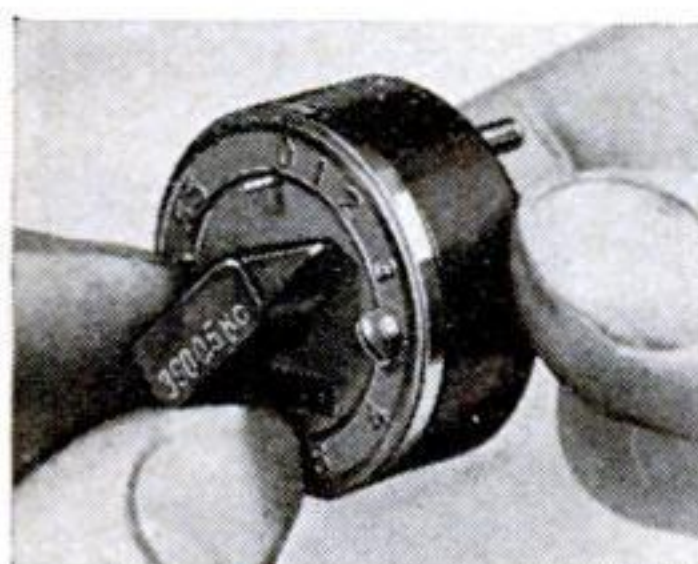


Switch Gives Old Sets Push-Button Tuning

TO ENABLE the home experimenter to provide his present receiver with modern push-button tuning, the convenient gang-switch selector pictured below has been placed on the market. Easily installed on the front panel of an existing set, the unit is available with either four, six, or eight selector buttons.

Adjustable Crystal Holder Improves Transmitters

AMATEURS operating low-power transmitters will find a valuable aid in the variable-frequency crystal holder shown. By turning the knob, the crystal frequency can be shifted over a $5\frac{1}{2}$ -kilo-cycle range.



Three Radio Circuits

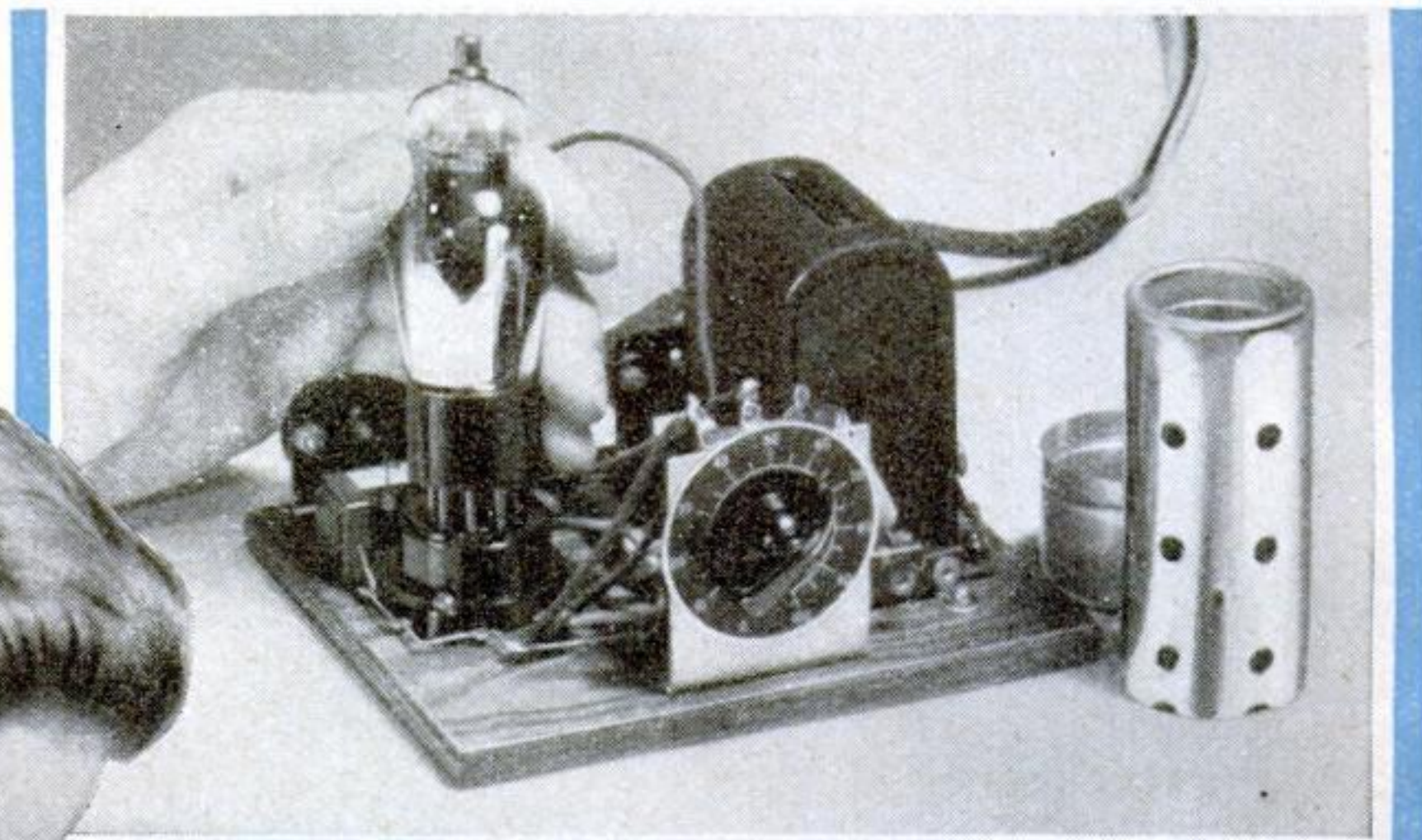
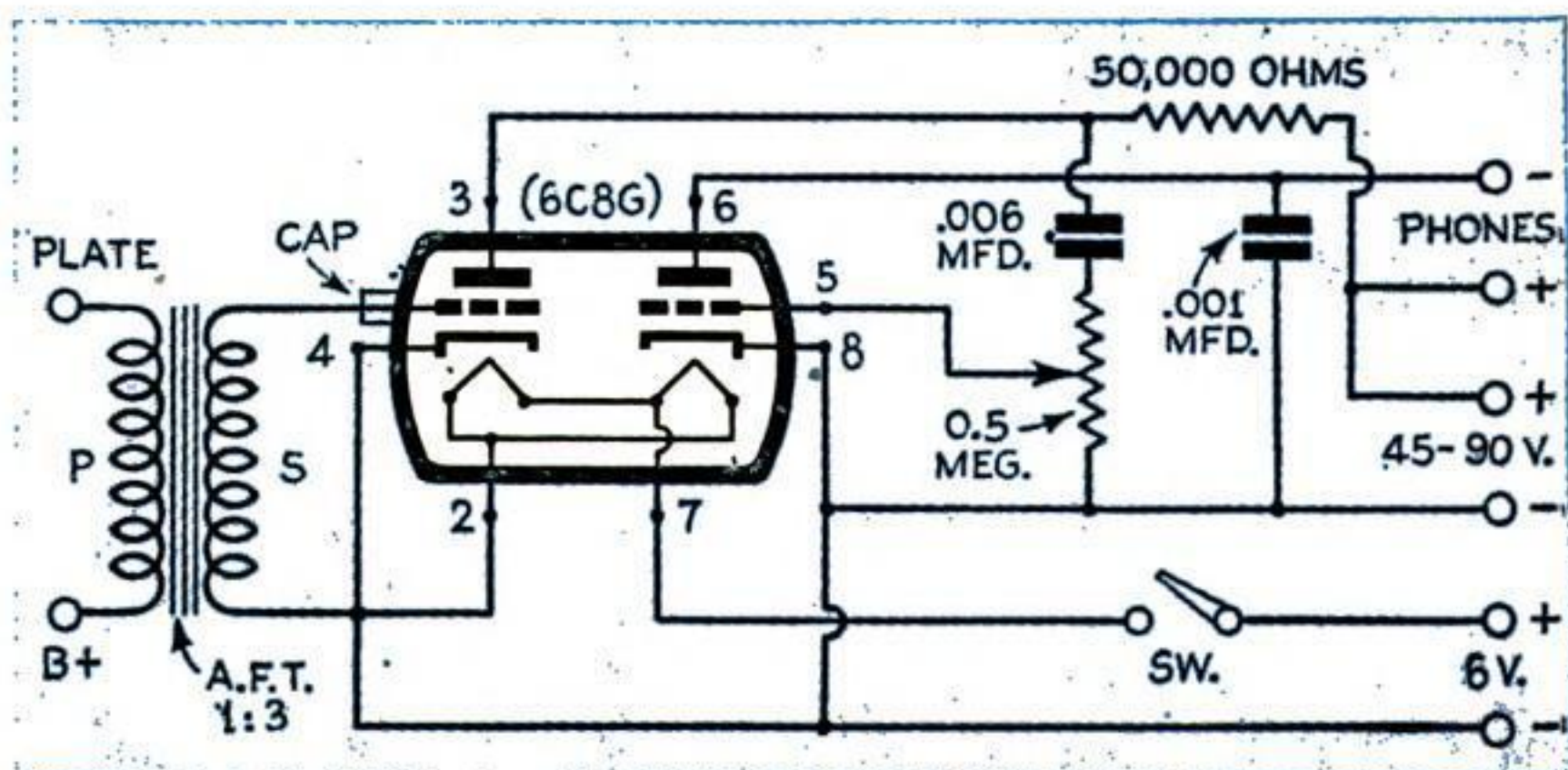
IF YOU like to experiment, the new 6C8G tube will provide you with many hours of interesting set construction and radio entertainment. With it and an inexpensive assortment of easily obtained parts you can construct three useful circuits—an all-wave battery receiver, an all-wave, all-electric set, and an efficient two-stage audio amplifier.

Because the tube is a double-purpose unit containing twin sets of elements, it can be made to do the work of two tubes, and in each of the hook-ups illustrated on these pages it is made to function in its dual capacity. In the all-wave battery receiver, it serves as a detector and audio-frequency amplifier; in the all-electric set, it provides both detector and rectifier; while in the amplifier it functions as two stages of resistance-coupled amplification.

For simplicity, each circuit has been mounted bread-board-fashion on a small 5½ by 6" rectangle of plywood. If desired, of course, they may be assembled on a regular

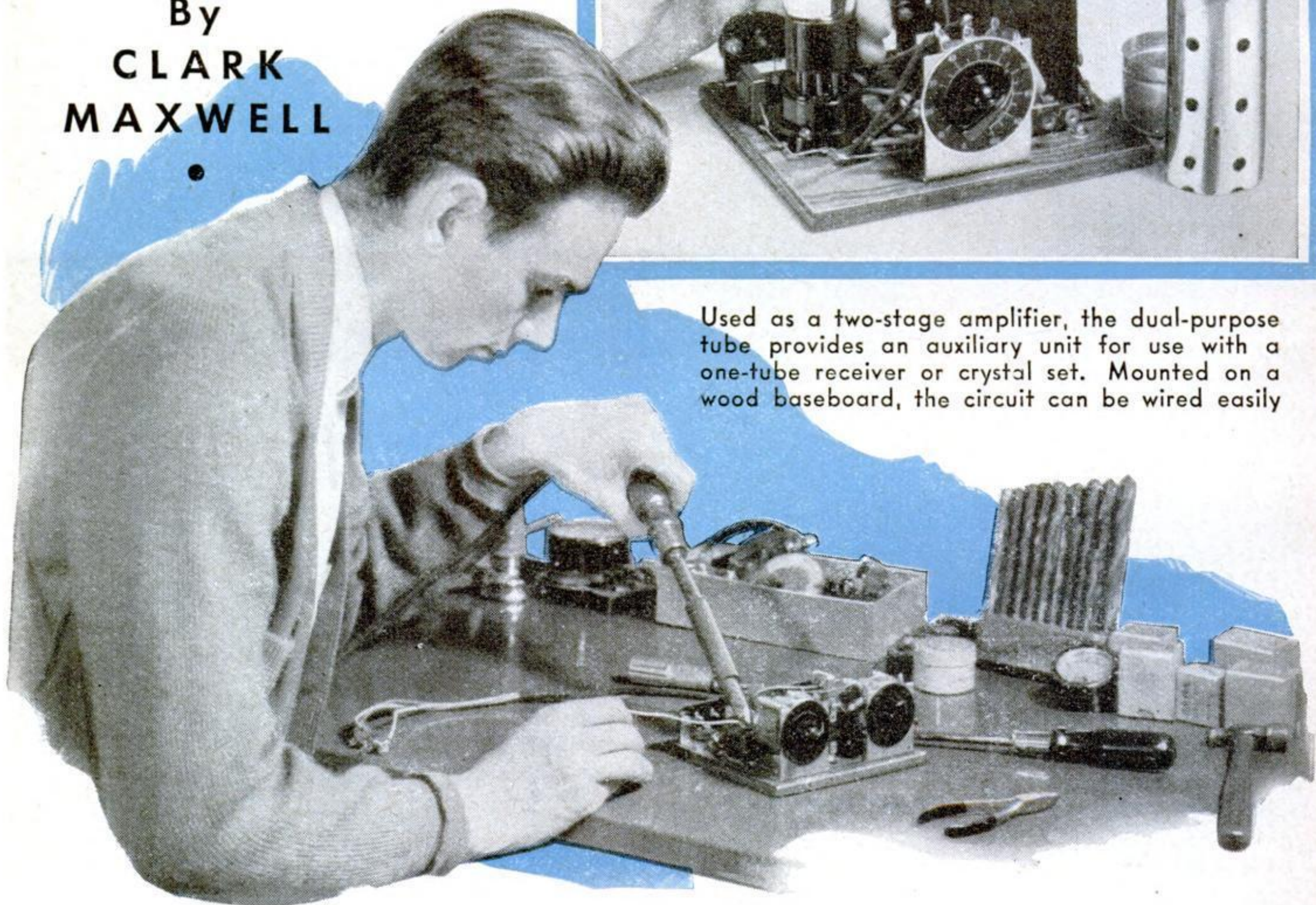
metal chassis, but for experimental purposes, the board requires less drilling and cutting and is much less expensive.

Being extremely easy to construct, the battery-operated receiver circuit provides a good starting point for your 6C8G experiments. As shown in the diagram and photograph on page 213, it is a detector-amplifier unit pro-

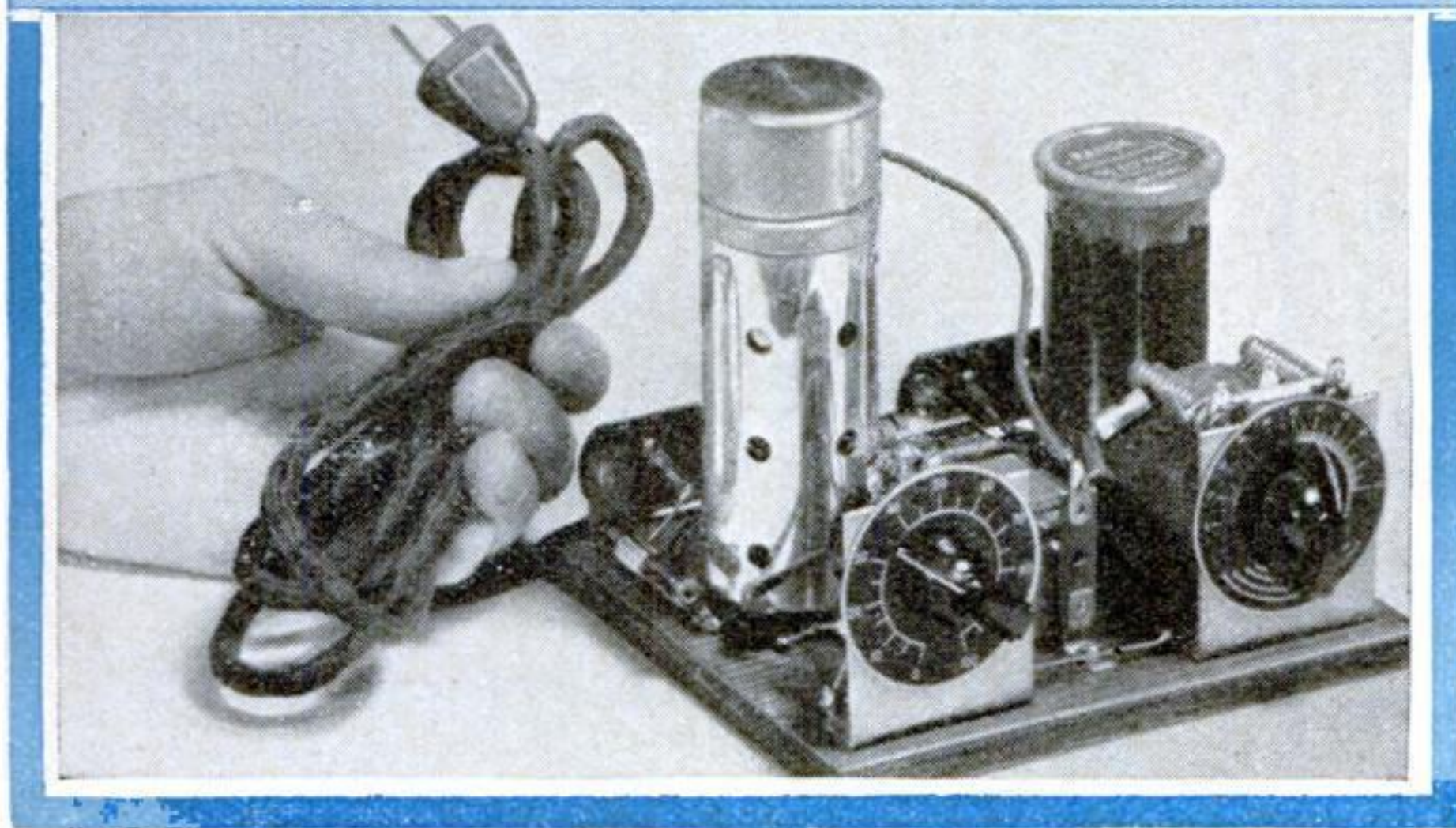
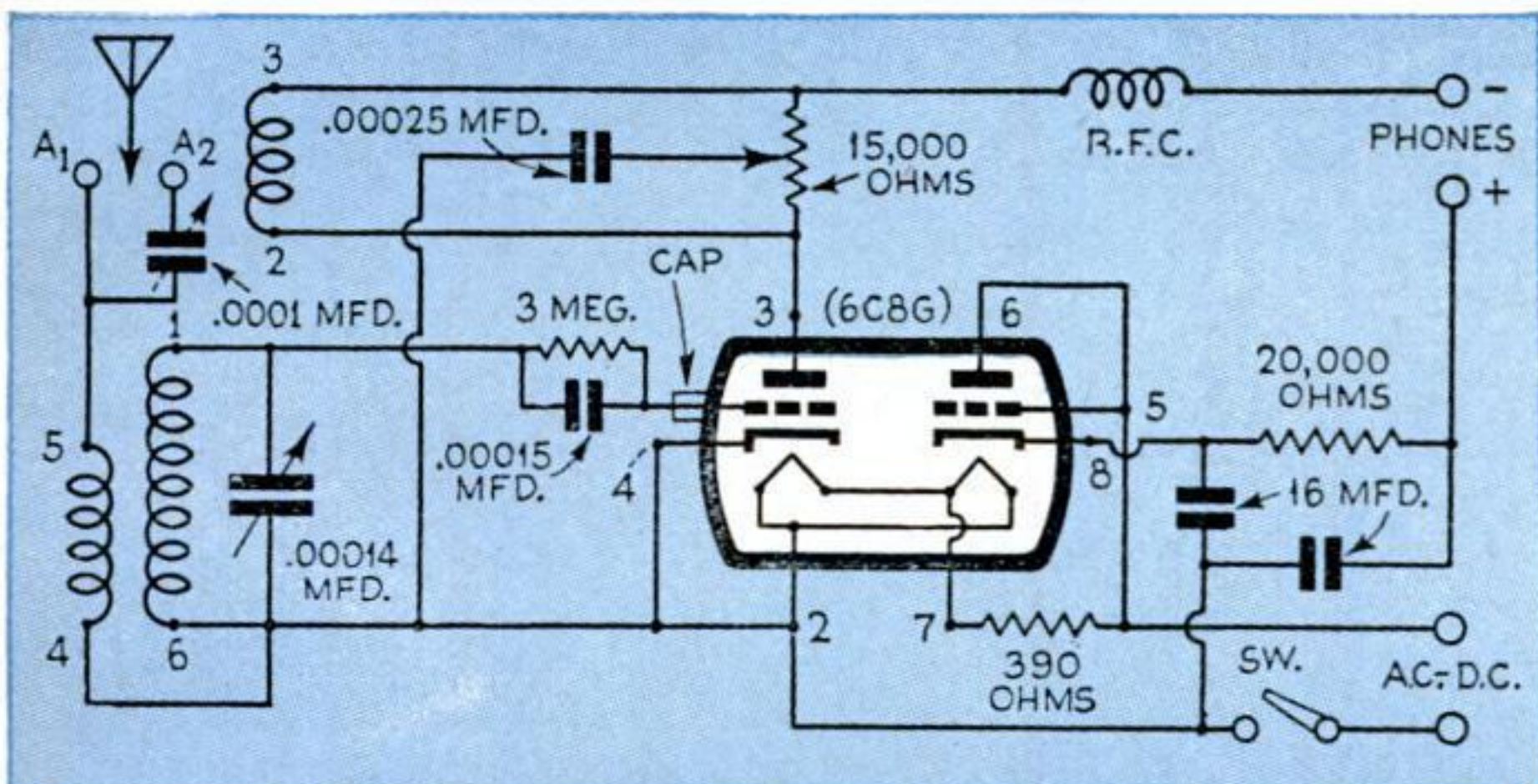


Used as a two-stage amplifier, the dual-purpose tube provides an auxiliary unit for use with a one-tube receiver or crystal set. Mounted on a wood baseboard, the circuit can be wired easily

By
**CLARK
MAXWELL**

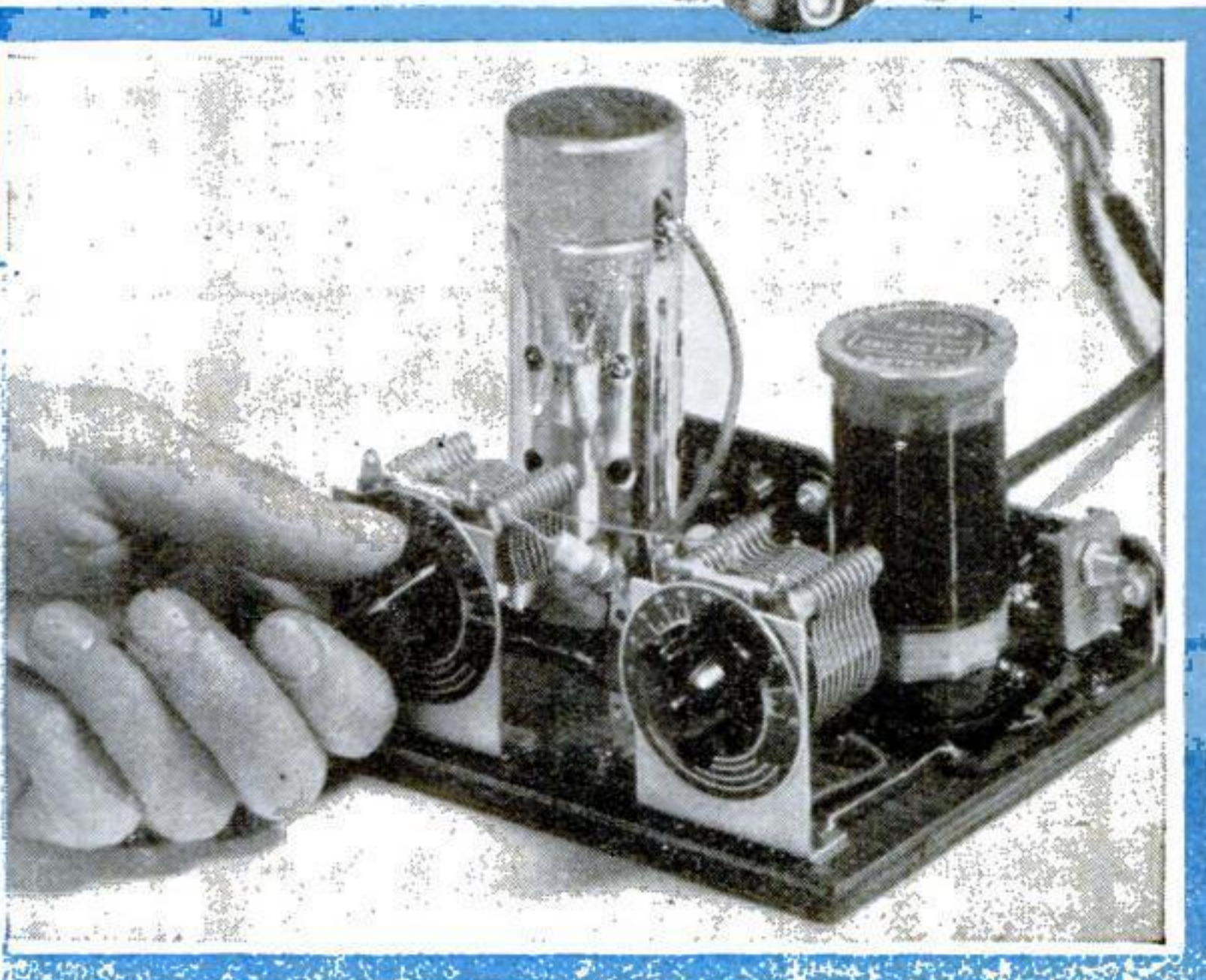
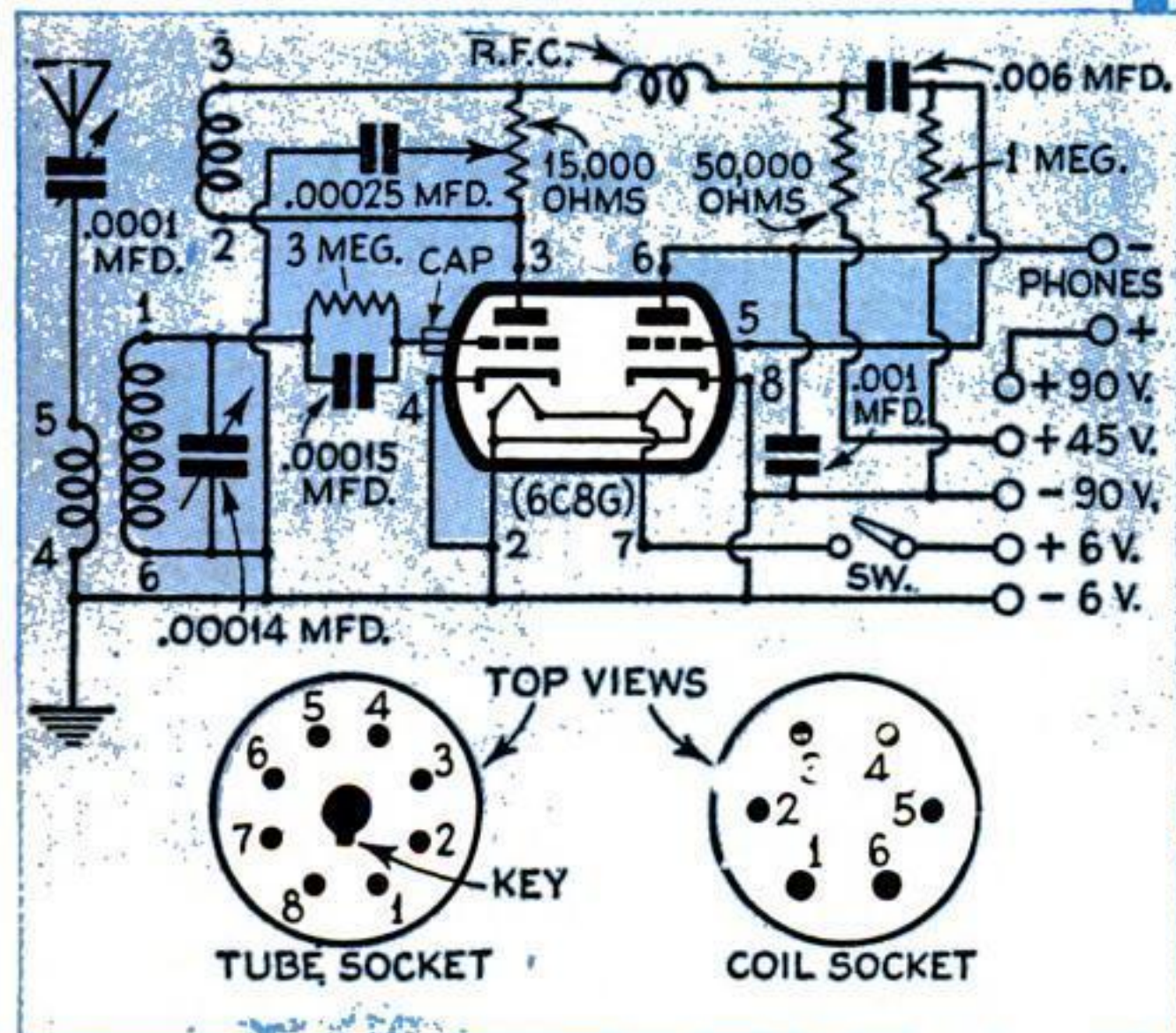


from One Tube



In the all-electric set, the tube serves as a detector-rectifier

viding all-wave reception through the use of standard plug-in coils. It operates with a filament current of six volts, which can be supplied by a storage battery or four series-connected dry cells, and a maximum plate current of ninety volts. How the tube and plug-in coils are wired is plainly shown in the socket diagrams. This receiver circuit gives surprisingly good results. Using the set in the heart of



The battery-receiver hook-up. Note how the tube and coil sockets are connected into the circuit

New York City, the author was successful in logging several European stations.

In the all-electric, A.C.-D.C. unit, the same 6C8G tube serves as a combined regenerative detector and rectifier, a 360-ohm resistor built into the power cord providing the necessary filament voltage. Like the battery circuit, this receiver utilizes plug-in coils to obtain all-wave reception. If the circuit tends to hum, place a metal shield over the tube, grounding it to the chassis if a metal mounting is used, or connecting it to the negative wiring if the unit is assembled on a wood board. Since the circuit is grounded through the house wiring, no outside ground can be used.

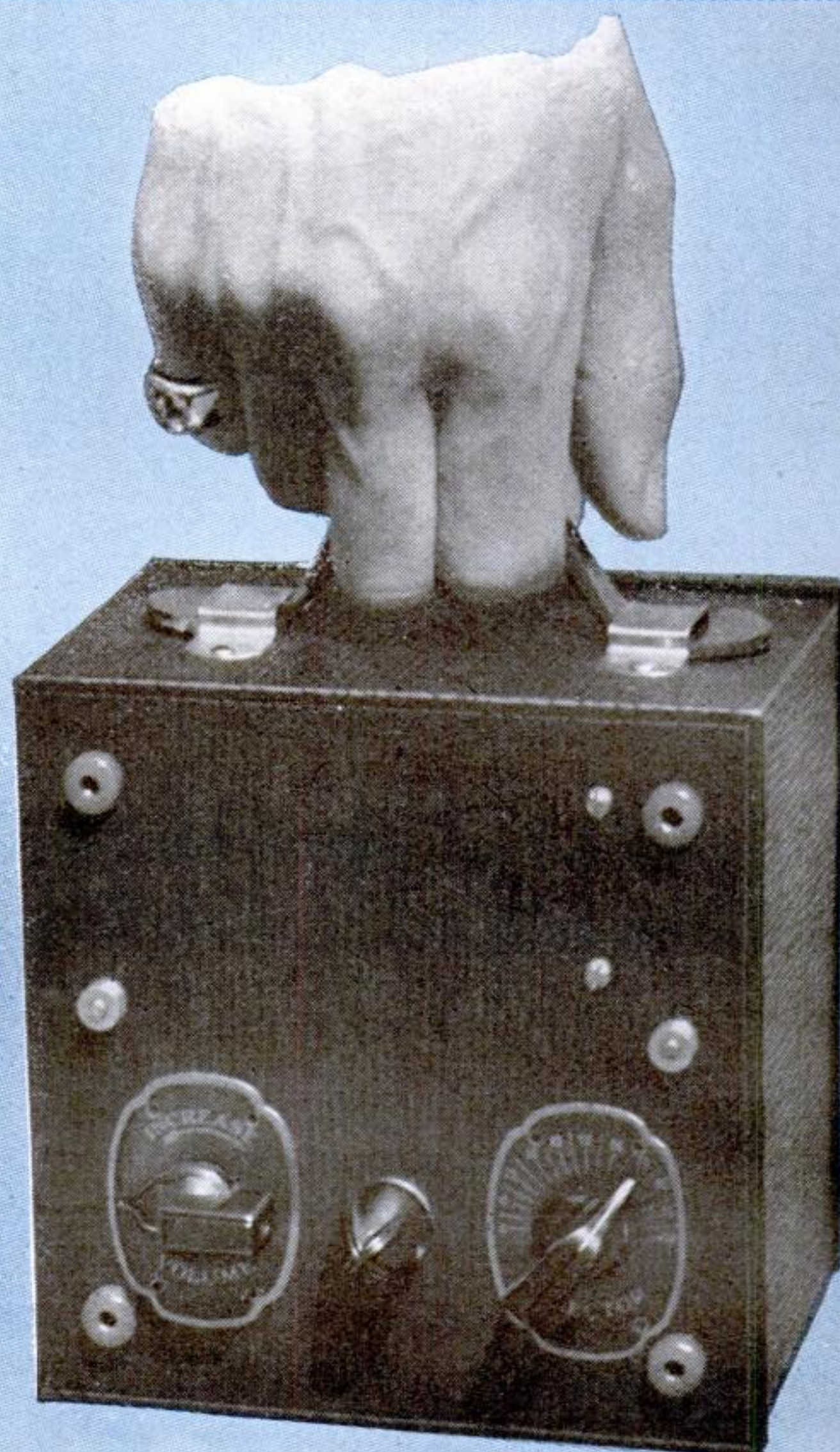
The third circuit—an efficient battery-operated, two-stage audio amplifier—can be used with any small set or with a crystal outfit. Provided with a transformer input it can be easily coupled to almost any unit. As shown in the diagram, the two sets of element within the 6C8G tube are resistance-coupled. A one-half megohm potentiometer is provided for volume control. Although in most cases best results will be obtained with a plate voltage of ninety, the circuit will operate satisfactorily on forty-five volts.

In wiring each of the circuits, follow the diagram for the tube socket as shown in the battery-receiver diagram. The numbers on the socket holes refer to the numbers on the tube elements indicated in the hookups.

LIST OF PARTS NEEDED

One 6C8G tube.
 Two variable condensers, .00014 mfd.
 Antenna trimmer condenser, .0001 mfd.
 Fixed condenser, mica, .00025 mfd.
 Fixed condenser, mica, .001 mfd.
 Fixed condenser, mica, .00015 mfd.
 Fixed condenser, tubular, .006 mfd.
 Dual electrolytic condenser, 16-16 mfd.
 Fixed resistor, 20,000 ohms, 1 watt.
 Fixed resistor, 3 megohms, $\frac{1}{2}$ watt.
 Fixed resistor, 1 megohm, $\frac{1}{2}$ watt.
 Fixed resistor, 50,000 ohms, $\frac{1}{2}$ watt.
 Variable resistor, 15,000 ohms, with switch.
 Variable resistor, 500,000 ohms, with switch.
 Radio-frequency choke, 2.5 mh.
 Audio transformer, 1-3 ratio.
 Line cord with resistor, 360 ohms.
Miscellaneous:—Set of six-prong plug-in coils, one six-prong socket, one eight-prong socket, knobs, dials, wire, solder, etc.

Flyweight



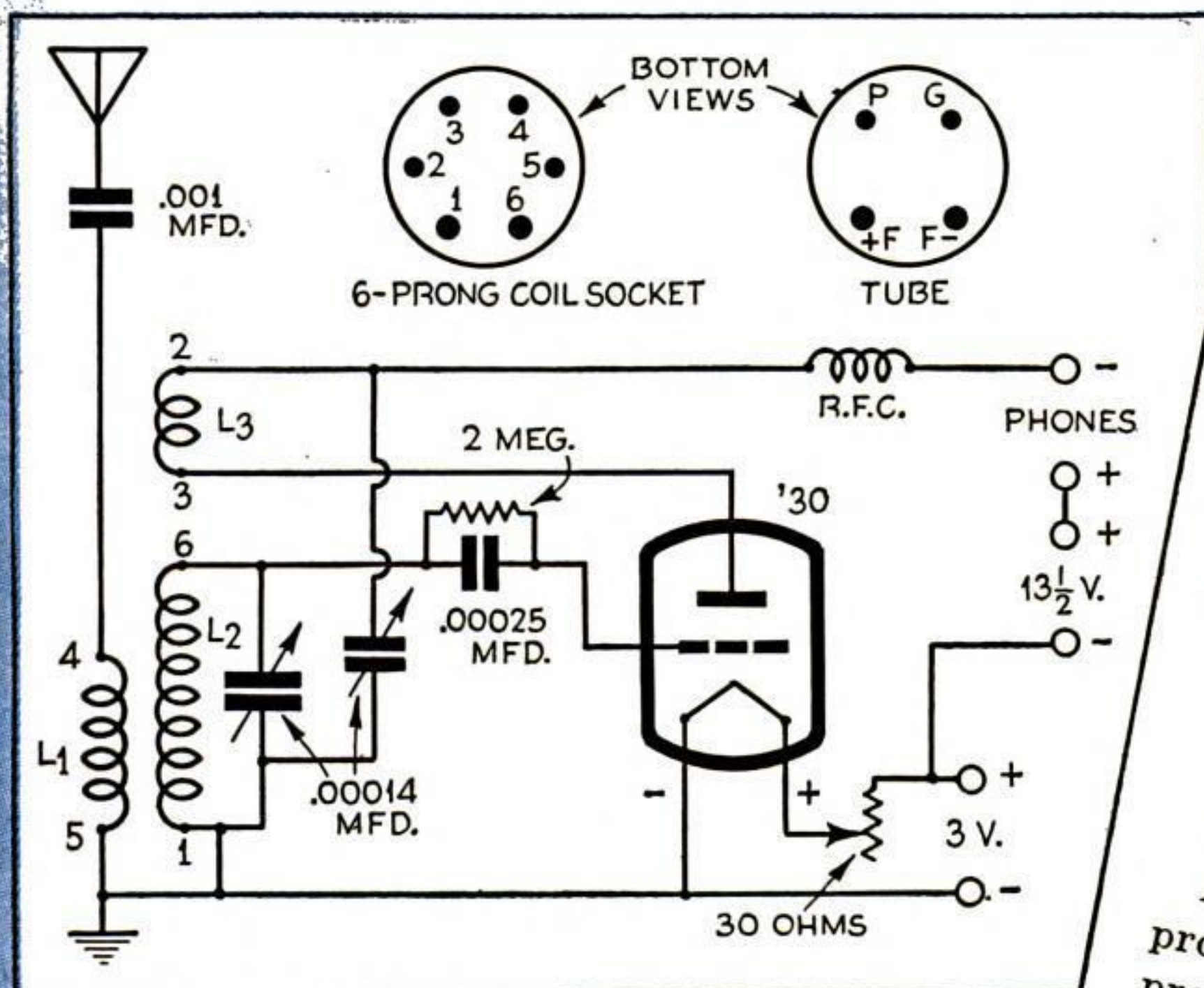
By ARTHUR C. MILLER

SIMILAR in size and shape to a box camera, this midget portable is an ideal receiver for use on picnics, hikes, and camping trips. Housed in its small black leatherette case is an efficient one-tube regenerative outfit complete with its power supply, which consists of two standard flash-light cells and three small $4\frac{1}{2}$ -volt "C" batteries. This saving of power-supply space is made possible through the use of a special "B"-batteryless circuit similar to one first described by the author a few years ago (P.S.M., July '36, p. 52).

The circuit consists of a six-prong coil in the antenna circuit tuned by a .00014-mfd. variable condenser. Another .00014-mfd. condenser controls regeneration and is connected between one end of the radio-frequency

Portable

RESEMBLES
A BOX CAMERA

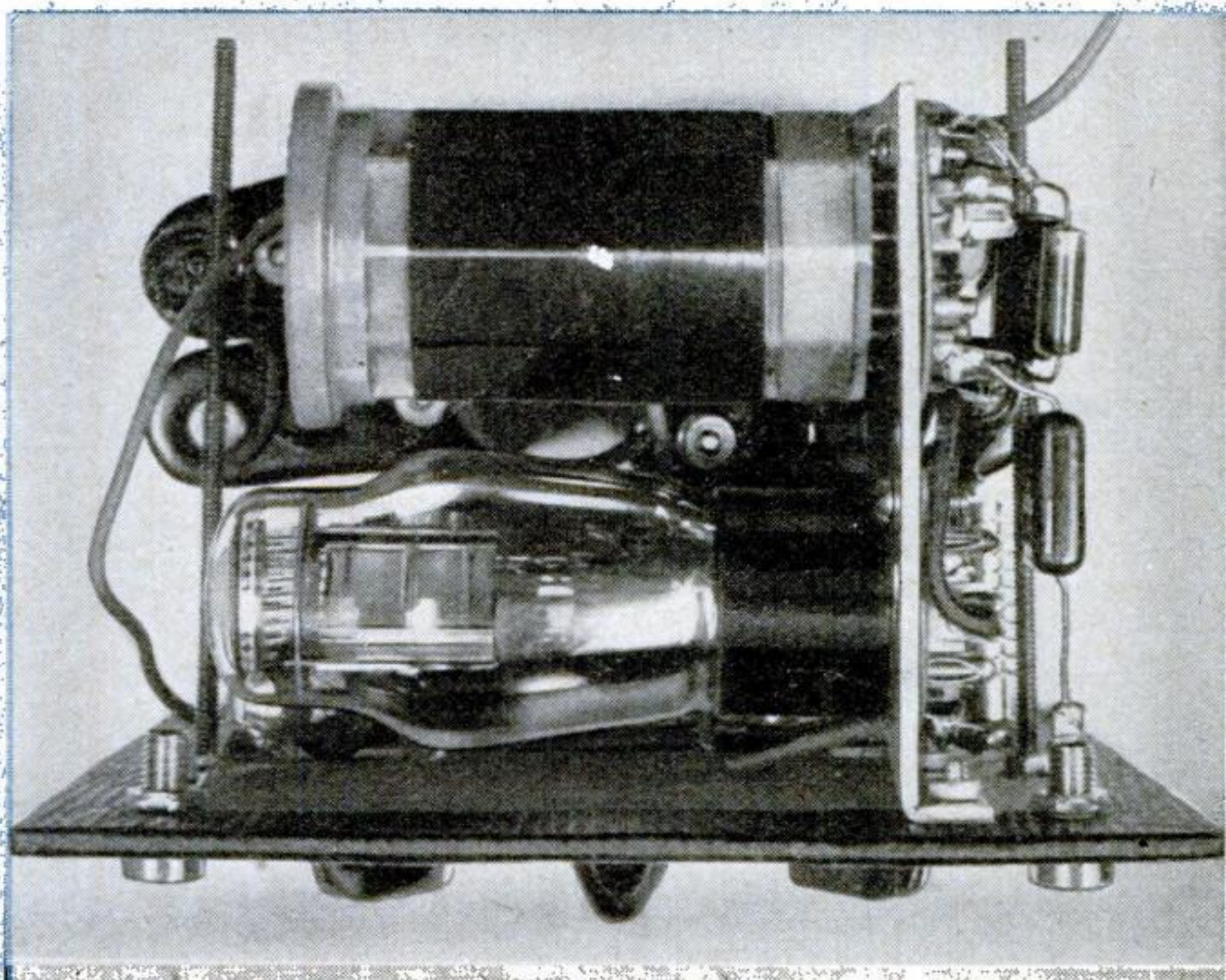
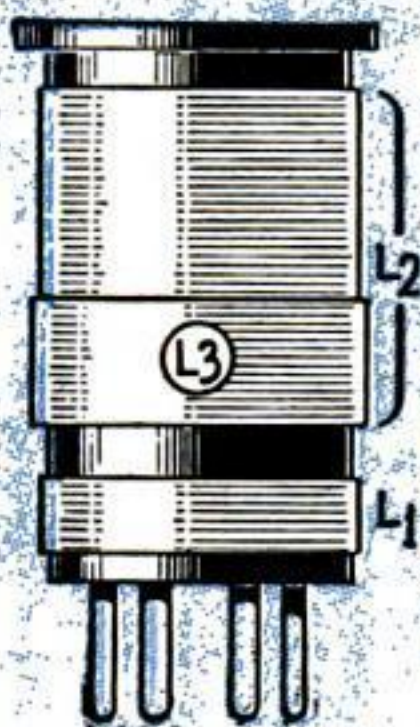


The circuit above, complete with its battery supply, is mounted in the small cabinet at the left.

quency choke and the ground. Prong connections to the coil, shown in the diagram, are not standard and apply only to the specific type of coil used in the original design. If another type of coil is used the smallest of the three windings should be used as the antenna coil (L_1). L_2 , or grid coil, is the largest winding, and is usually wound in plain enamel wire.

To obtain greater selectivity when using a long antenna, a .001-mfd. mica fixed condenser was included in the antenna lead to L_1 . If a short antenna is used, this fixed condenser may be omitted. On the other hand, should the antenna be exceptionally long, it may be well to substitute a .0025-mfd. condenser for the .001-mfd. unit.

The cabinet, whose inside dimensions are $3\frac{1}{2}$ by $5\frac{1}{8}$ ", is constructed of wood $\frac{5}{16}$ " thick covered with black leatherette material.



Top view of the receiver showing how the L-shaped metal chassis is mounted vertically. The sketch shows the coil and windings

LIST OF PARTS

Two variable condensers, .00014 mfd.

Fixed condenser, mica, .00025 mfd.

Fixed condenser, mica, .001 mfd.

Fixed resistor, 2 megohms, $\frac{1}{2}$ watt.

Rheostat, 30 ohms.

Radio-frequency choke.

One type '30 tube.

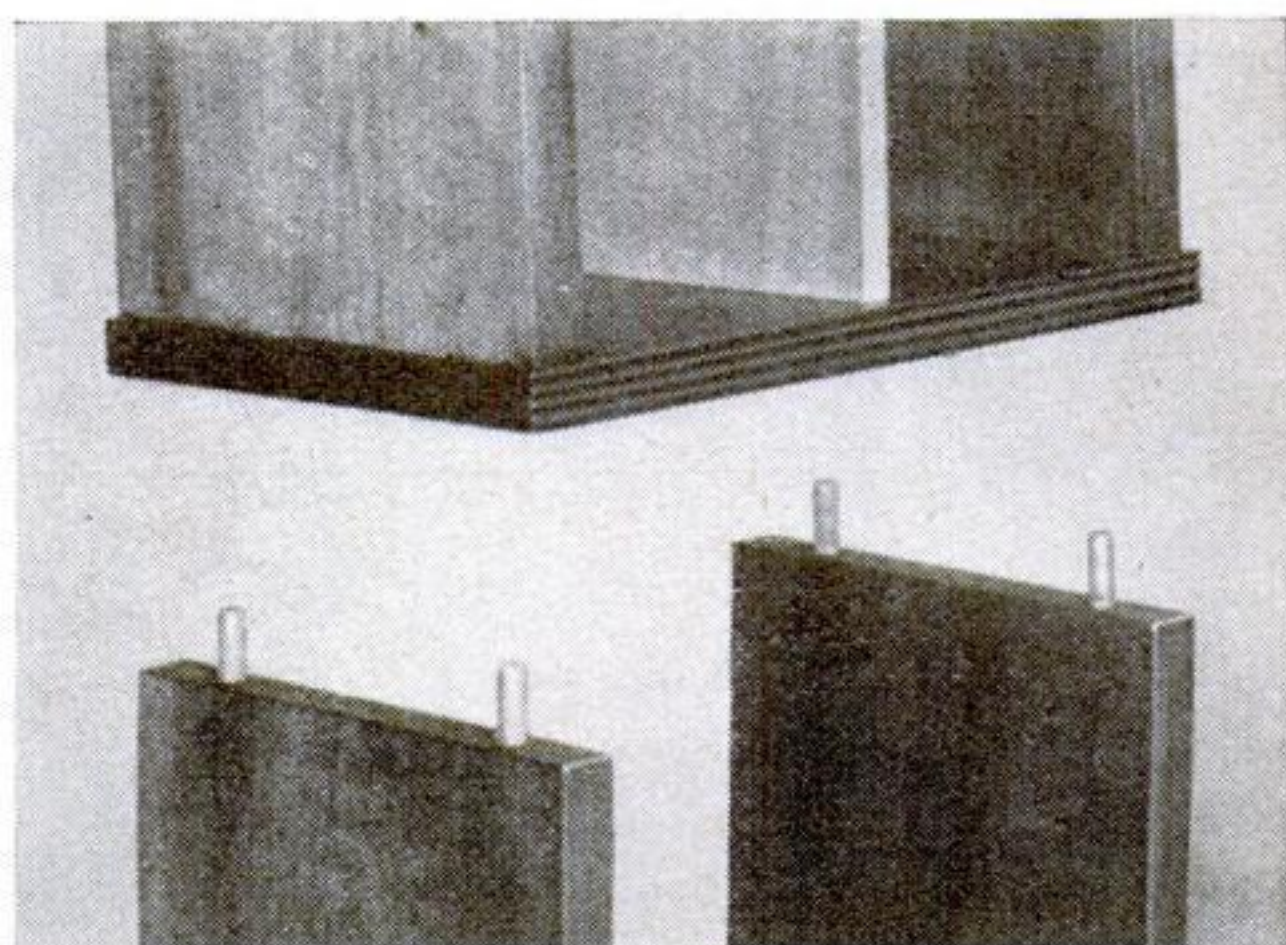
Miscellaneous:—Set of six-prong plug-in coils, one four-prong wafer socket, one six-prong wafer socket, earphones, two flash-light cells, three $4\frac{1}{2}$ -volt "C" batteries, knobs, dials, cabinets, lugs, screws, wire, solder, etc.

New POPULAR



Made in two attractive but easily built units, it holds forty-eight magazines of the present size and has a sliding stop to keep them aligned

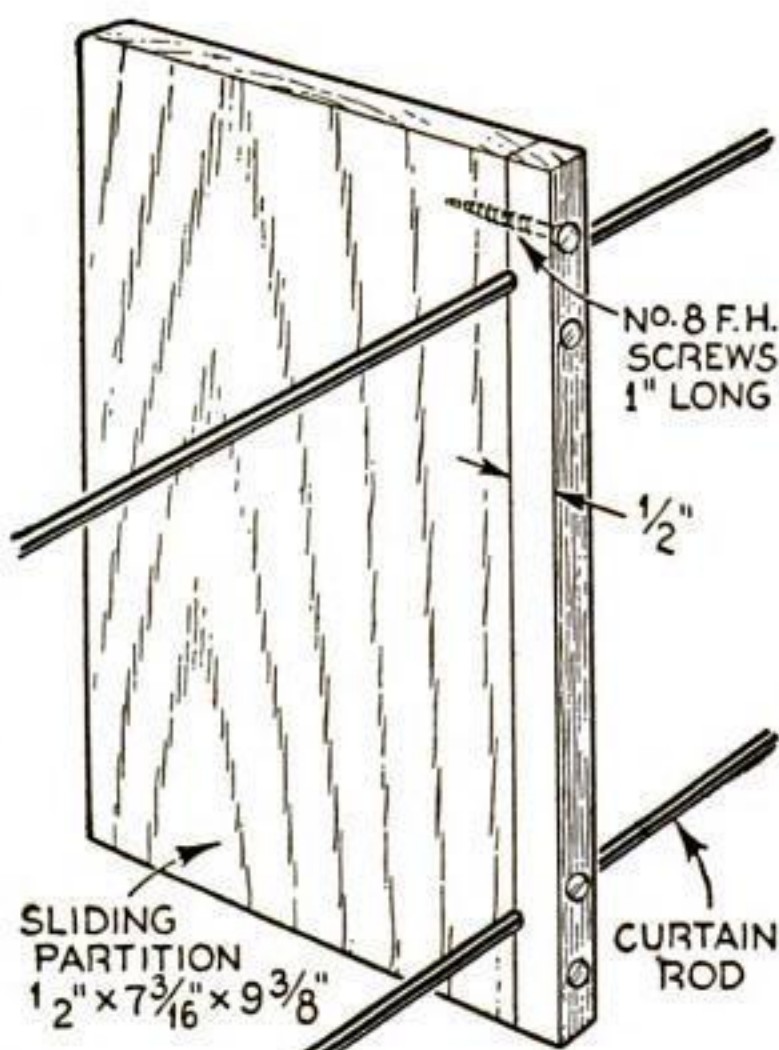
Used alone, the upper section is large enough for a two years' file of Popular Science. The lower part, which can be built now or added later, is doweled on as at right



HERE is a compact, attractive, substantial bookcase to enable you to preserve and keep handy a complete file of the new size POPULAR SCIENCE MONTHLY. As a rule, when magazines are stored upright on a shelf, they sag limply and bend out of shape. This design avoids that difficulty in an ingenious way. A sliding partition, made as illustrated, automatically locks in any position and holds the magazines in perfect alignment. The construction throughout is of the simplest type.

The top section of the case is large enough for twenty-four magazines. The lower section and base, which can be built later, if desired, after the top part is almost filled, provide space for an equal number. The complete case will therefore hold your POPULAR SCIENCE file for four years to come.

Almost any wood may be used, but so little is required that it pays to get a good cabinet wood, especially if the piece is to be finished to match other furniture rather than enameled or lac-



The sliding partition for holding the magazines upright and neatly aligned. The tension is adjusted by tightening the screws

quered. The list of materials is given below.

Begin by making the upper section, which consists of the top, bottom, and two sides. Square these pieces to dimensions and lay out the two $\frac{1}{4}$ " holes for the brass rods on each side. To do this accurately, make a cardboard template $9\frac{3}{8}$ " high and about 2" wide. Mark a line $\frac{1}{2}$ " from the rear edge and square lines across it $1\frac{1}{4}$ " from each end (see

MATERIALS FOR BOOKCASE

UPPER UNIT

No.	Pc. Description	T.	W.	L.
2	Sides	$\frac{3}{4}$	$7\frac{5}{8}$	10
1	Top	$\frac{3}{4}$	$7\frac{5}{8}$	$11\frac{1}{2}$
1	"	$\frac{1}{4}$	$7\frac{1}{4}$	10
1	"	$\frac{1}{4}$	$6\frac{7}{8}$	$8\frac{1}{2}$
1	Bottom	$\frac{3}{4}$	$7\frac{7}{8}$	12
1	Slide	$\frac{1}{2}$	$7\frac{1}{2}$	$9\frac{3}{8}$
2	Curtain rods (brass) $\frac{1}{4}$ dia.			$10\frac{1}{2}$

LOWER UNIT

2	Sides	$\frac{3}{4}$	$7\frac{5}{8}$	10
1	Bottom	$\frac{3}{4}$	$7\frac{5}{8}$	$11\frac{1}{2}$
1	Base	$\frac{3}{4}$	$7\frac{7}{8}$	12
2	"	$\frac{1}{4}$	$7\frac{7}{8}$	1
2	Curtain rods (brass) $\frac{1}{4}$ dia.			$10\frac{1}{2}$

Note: All dimensions are given in inches and are finished sizes.

SCIENCE Bookcase

detail drawing of slide). Place the template on each side, flush with the bottom and rear edge, and prick through the cardboard where the lines intersect. Bore the four holes to a depth of $\frac{1}{4}$ ". Cut two pieces of $\frac{1}{4}$ " curtain rod, $10\frac{1}{2}$ " long. These may be inserted in the holes before gluing, or after gluing if a downward-slanting groove or inlet to the hole is cut in one of the sides.

Now glue and nail the top to the two sides, but size the end wood with thin glue beforehand. Nail a piece of scrap wood, 11" long, temporarily to the underside, making sure that the sides are square with the top.

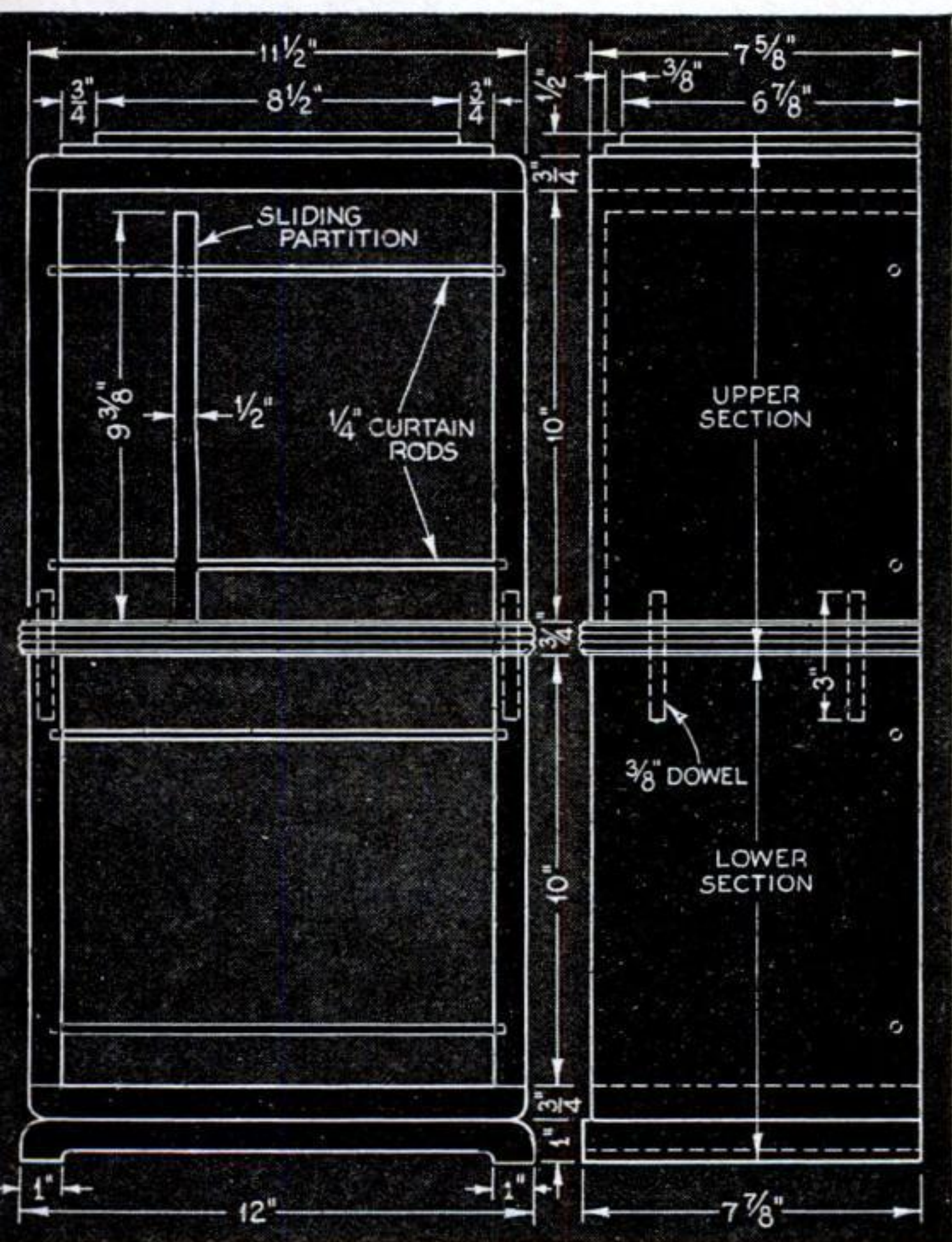
When the glue is dry, set the nails below the surface and fill the holes with stick shellac or other filler. Leave the temporary bottom in place while smoothing the surfaces and rounding the corners. To decorate the top, two $\frac{1}{4}$ " pieces are glued on as shown. The front and side edges of the bottom board may be beaded, if desired, with a scratch stock as explained in a previous issue (P. S. M., June '38, p. 71). The temporary bottom is now removed and the permanent one glued and screwed in place. Use three $1\frac{1}{4}$ " No. 9 screws in each side.

To keep the magazines in an upright position until the bookcase is filled, a piece of wood is made as shown to slide on the two brass rods. Cut a piece of $\frac{1}{2}$ " stock to exact length ($9\frac{3}{8}$ "), but make it about $7\frac{1}{2}$ " wide. Bore holes in the rear edge and drive four 1" No. 8 flathead screws at the approximate points indicated on the drawing. Remove the screws and rip off a $\frac{1}{2}$ " wide strip. Screw the two pieces together again—they will fit exactly—and lay out the position of the $\frac{1}{4}$ " holes from the cardboard template. Bore these holes, cut the slide to exact width ($7\frac{3}{16}$ "), remove the screws, and reassemble the slide over the brass rods. If the holes are too big, take it apart and plane the edges; if

too small, insert a piece of paper in the joint. The slide can be made to look like a magazine by gluing a strip of white paper to the front edge and then sticking on the backstrap lettering from an old copy of POPULAR SCIENCE.

The lower section is made like the first but without a top, and the two are joined with $\frac{3}{8}$ " dowels. A base made of a $\frac{3}{4}$ " board, to which a strip of $\frac{1}{4}$ " stock has been glued at each end, is shaped as shown and screwed to the underside of the lower section. When the upper section is full of magazines, the slide should be removed and used in the second section. A back of thin plywood, covering both sections, may then be nailed to the bookcase.

Rubbing last coat of shellac with 6/0 waterproof sandpaper and oil. At left, working drawings



The case may be stained and finished with coats of thin shellac or varnish, or it may be painted with colored enamel or lacquer. If shellac is used, rub down each coat with No. 3/0 steel wool and the last coat with No. 6/0 waterproof sandpaper and crude oil.

This bookcase was designed for POPULAR SCIENCE MONTHLY by Herman Hjorth, noted woodworking authority.



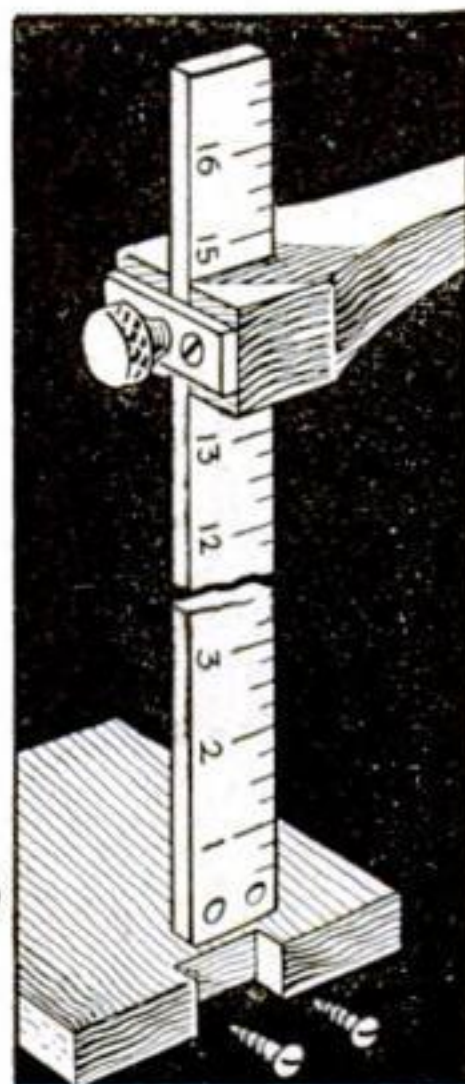
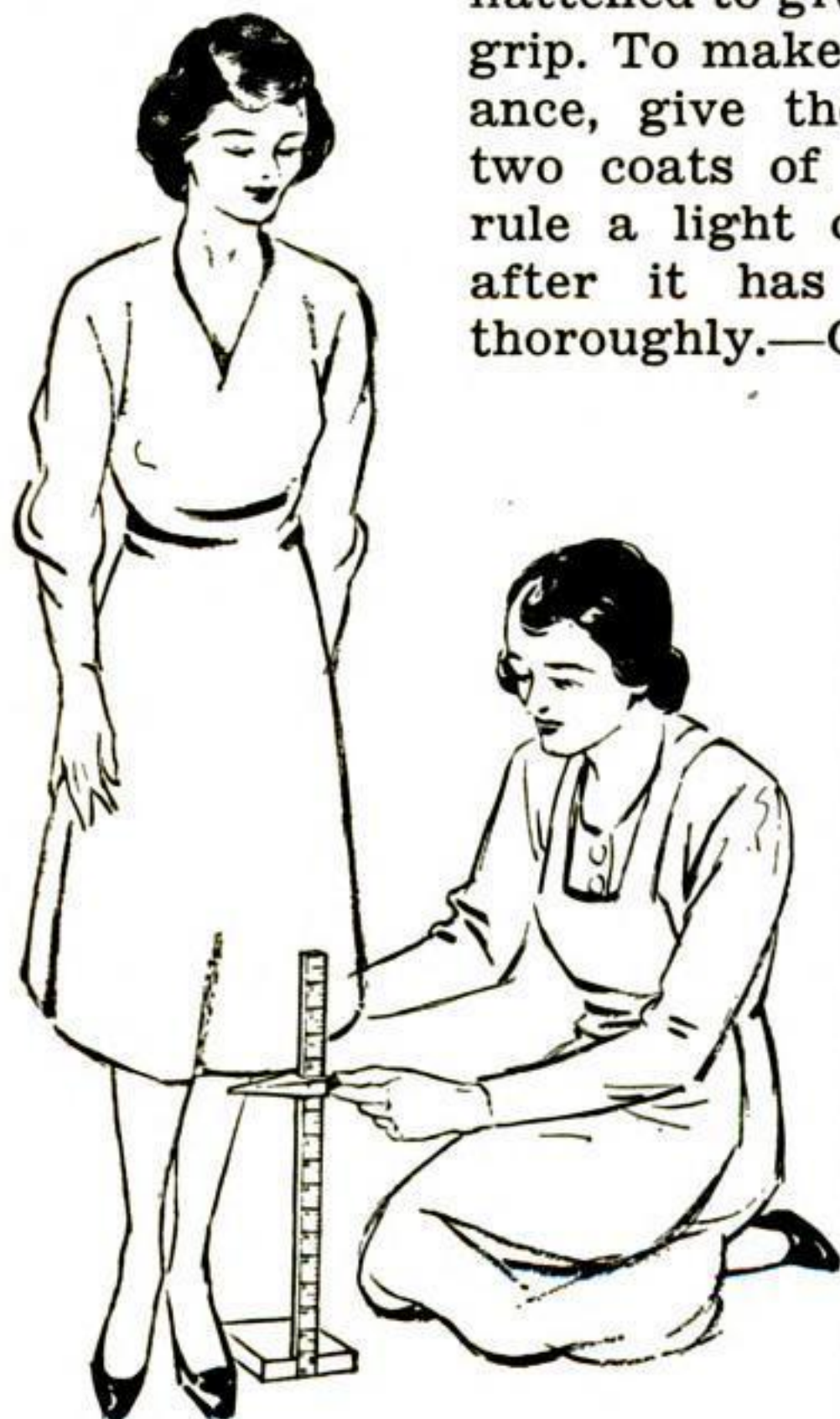
The cork is split to hold the handle

Glass Cutters Kept in Turps

GLASS cutters not only work better if they are dipped in turpentine or kerosene before use, but they also last longer if kept immersed in the liquid when not in use. A bottle may be partly filled with turpentine and fitted with a split cork that has a hole in the center large enough to fit the glass-cutter handle.

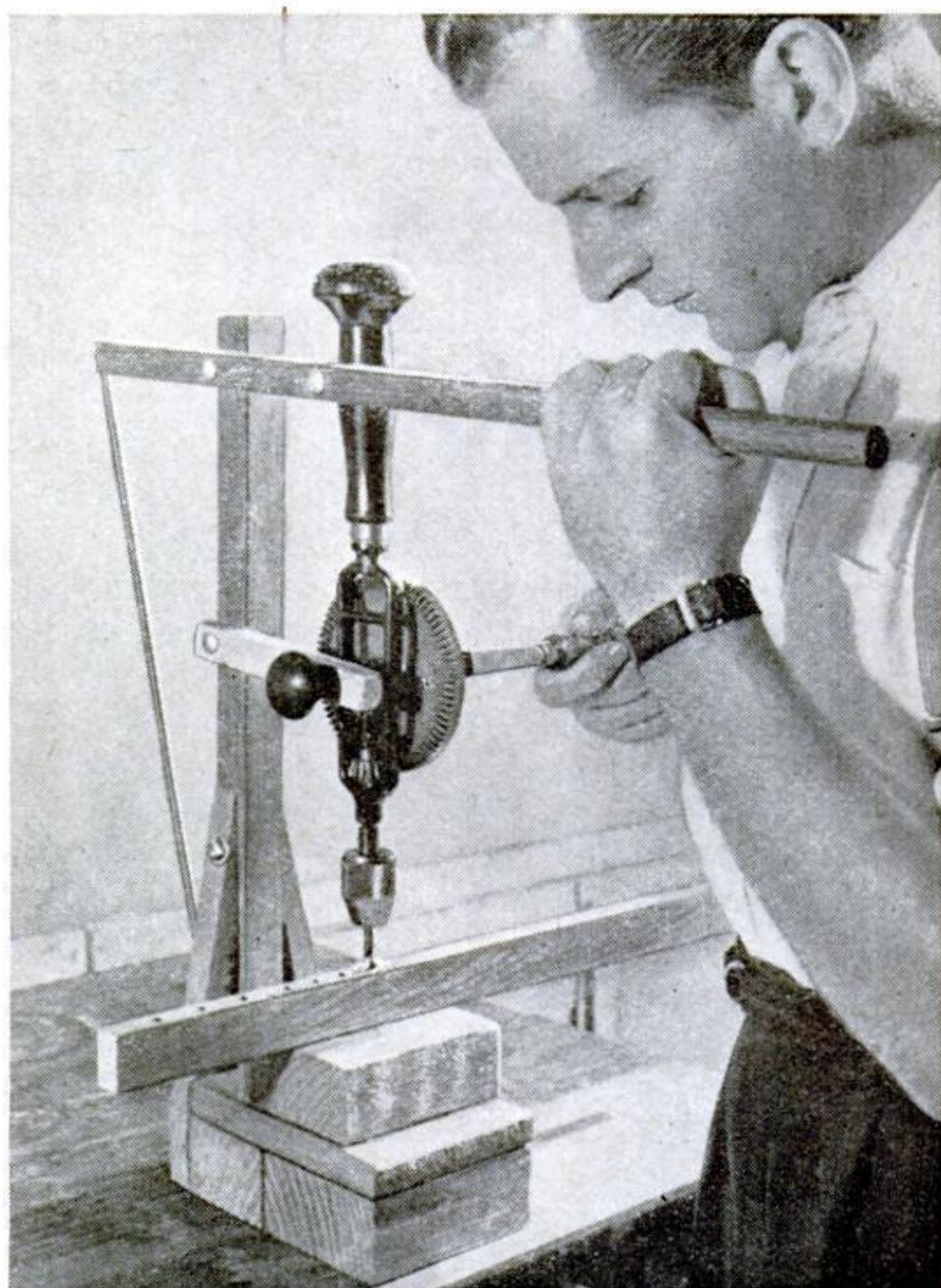
An Adjustable Skirt Gauge for Home Dressmakers

FOR home dressmakers, the gauge illustrated below aids in marking the length of skirts while being fitted. A portion of a yardstick is fastened to a base about $\frac{7}{8}$ " by 6" by 6". A pointer is shaped as shown and slotted slightly deeper and wider than the width and thickness of the yardstick. A small brass, iron, or even hardwood bar, tapped for a $\frac{1}{4}$ " bolt, is screwed to the slotted end so the pointer may be set with the aid of a thumb screw or an ordinary bolt which has been heated and flattened to give a good finger grip. To make a neat appearance, give the base one or two coats of paint and the rule a light coat of shellac after it has been cleaned thoroughly.—C.A.V.



Hand-Operated Drill Press Improvised from Wood

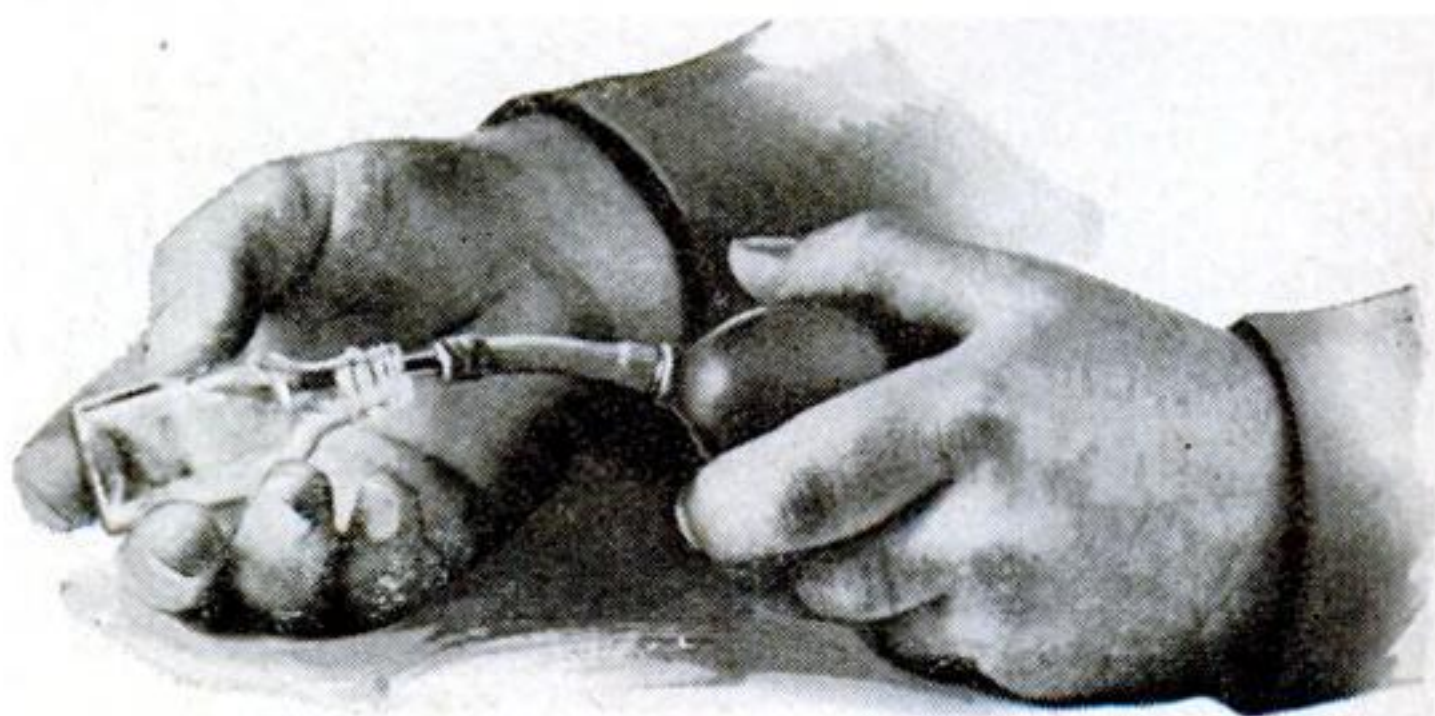
WHEN a large number of holes have to be drilled and only a hand drill is available, a drill press may be improvised from scraps of wood as shown below. The only expense is five cents for a door spring. The hand drill is not damaged because only one hole has to be drilled through the handle for attaching to the lever.—DAVID STEWART.



Hand drill set up in a quickly improvised wooden press so that holes can be drilled with less effort

Atomizer Speedily Dries Small-Necked Bottles

AFTER they have been washed, small bottles with narrow mouths can be quickly dried inside by warming them slightly and blowing air into them with a discarded atomizer bulb as illustrated.



Carving Grotesque Heads FOR USE IN NOVELTIES



YOU can allow your imagination to run wild when carving grotesque miniature heads of the type illustrated. They can be made in various sizes and used for novelty costume jewelry such as bracelets, clips, brooches, and even rings. Lamp pulls, curtain hold-backs, bottle corks, desk and smoking sets, and all sorts of small craftwork articles can also be ornamented with the heads.

Obtain a stick of clear, straight-grained softwood such as whitewood, about $\frac{3}{4}$ " by $\frac{3}{4}$ " by 12", and whittle a head at the end. You may use a well-sharpened penknife or one of the new type knife sets that have small scalpel-like cutters of various shapes. After one head has been carved, remove it with a coping saw and start another. Endeavor to make each head more grotesque than the one before.

You can start by copying the heads illustrated in the photographs, or make up your own designs as you go along.

Sandpaper the heads carefully and apply several coats of four-hour black enamel; then

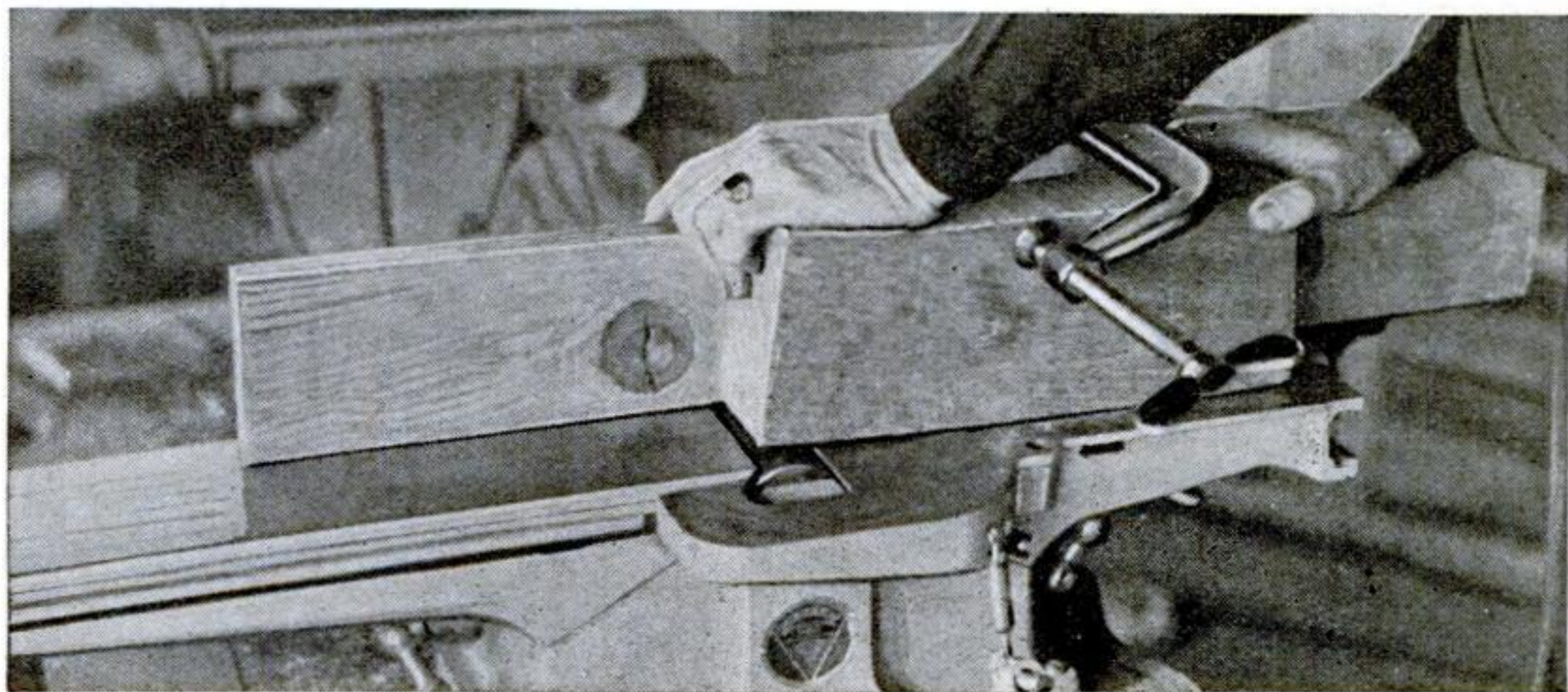


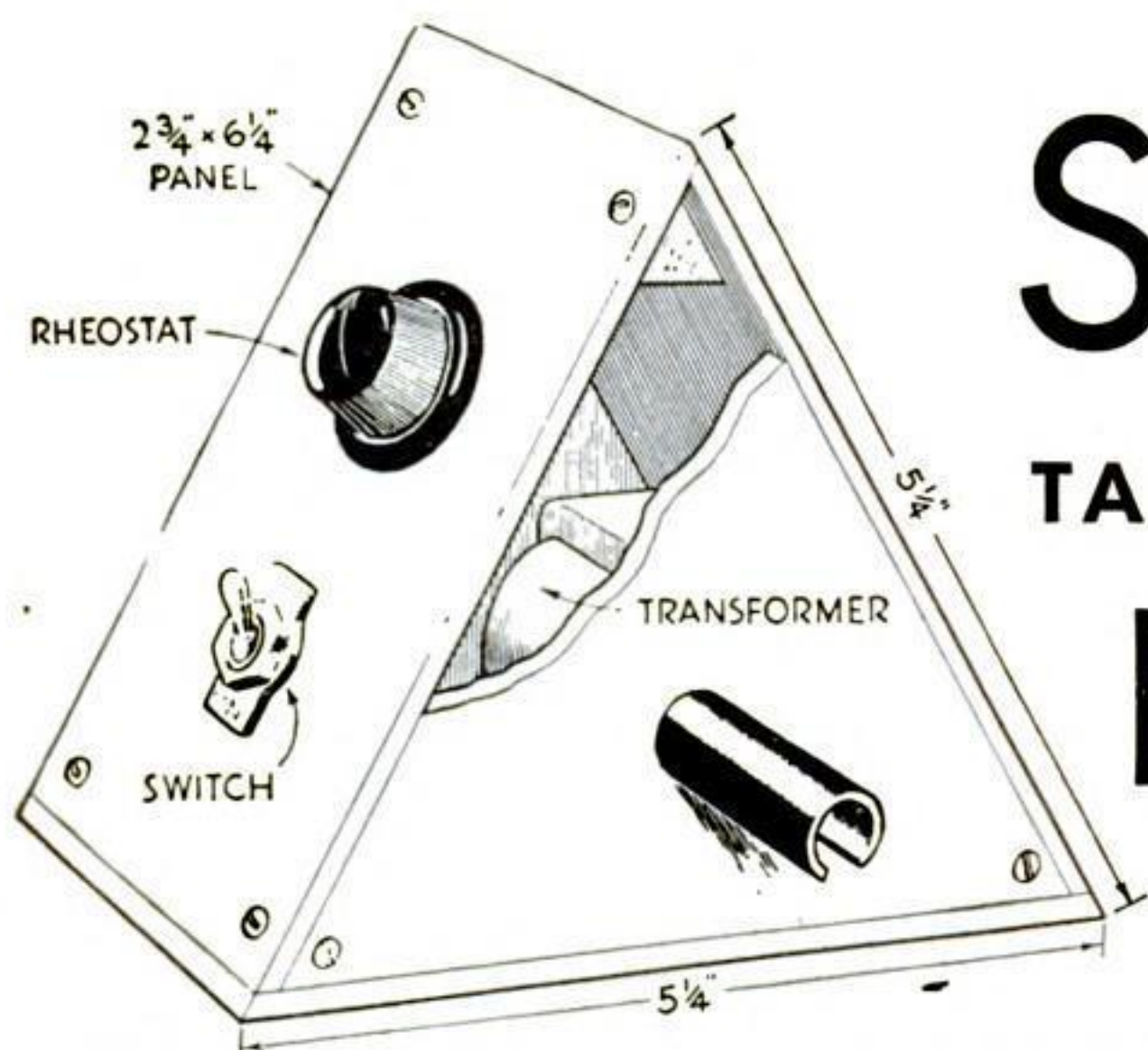
paint the faces with brilliant primary colors and brown, medium green, and white so they resemble totem-pole heads or the weird ritual masks of various Indian tribes.

For a bracelet like that illustrated, it is necessary to provide cylinderlike beads as spacers between the heads. Two holes are drilled through each head and bead to take hat elastics, which may be purchased, two on a card, for five cents. Overlap the ends of the elastics and fasten them together with fine wire.—JOSEFA CLARK.

How to Guide Small Pieces Safely over a Jointer.

SMALL pieces of wood that might be dangerous to hold by hand when running them over the jointer can be clamped to a larger board as shown at right. This will serve as a guide along the jointer table and fence, and makes the job much safer, and easier as well.—BROOKS HILL.

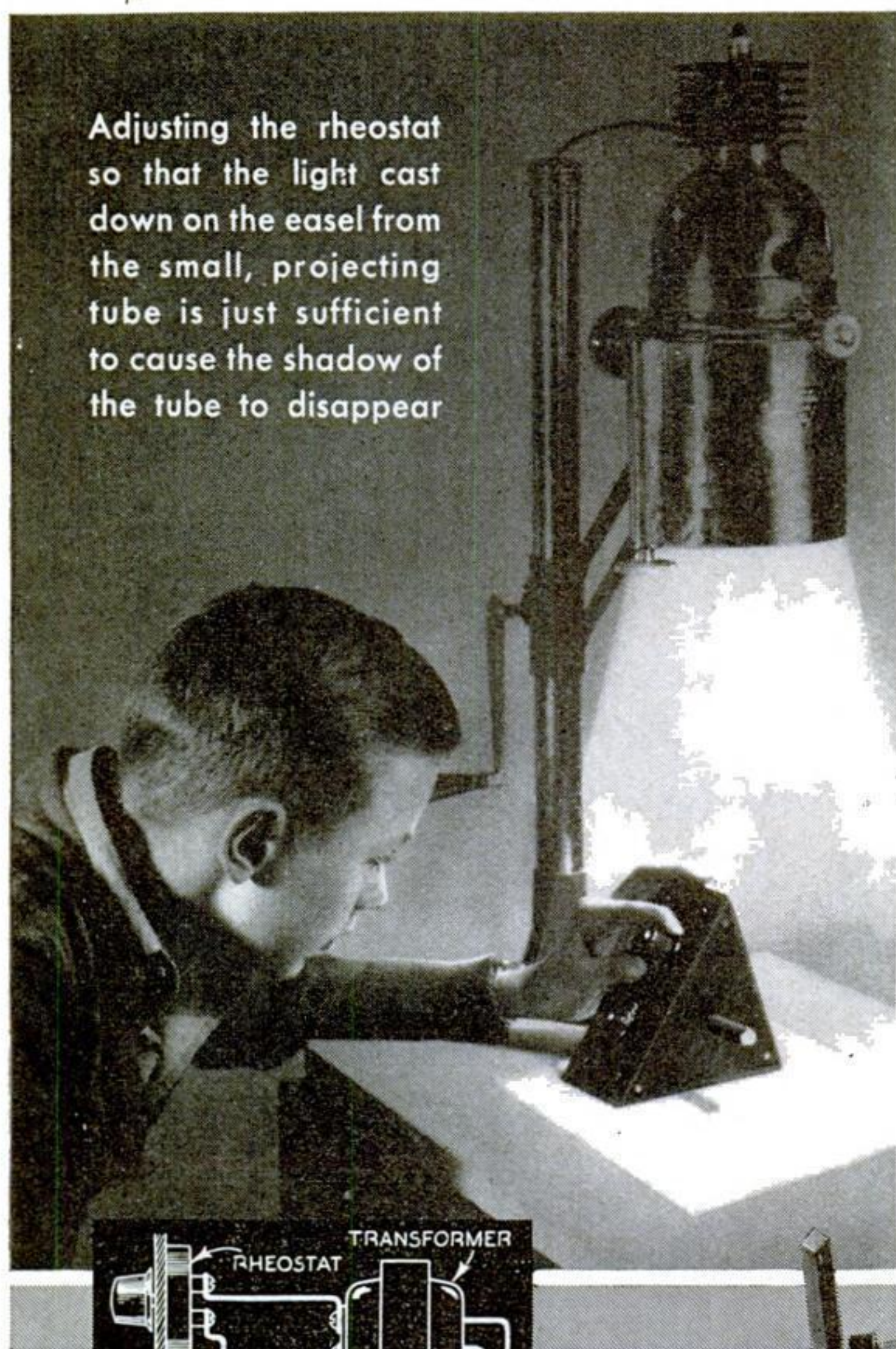




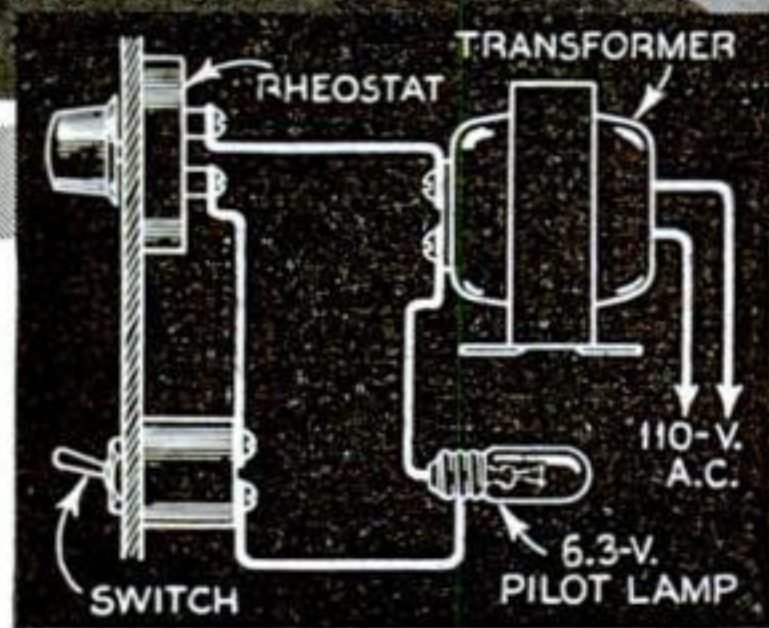
Simple Meter

TAKES THE GUESSWORK OUT OF ENLARGING

By KENNETH MURRAY



Adjusting the rheostat so that the light cast down on the easel from the small, projecting tube is just sufficient to cause the shadow of the tube to disappear



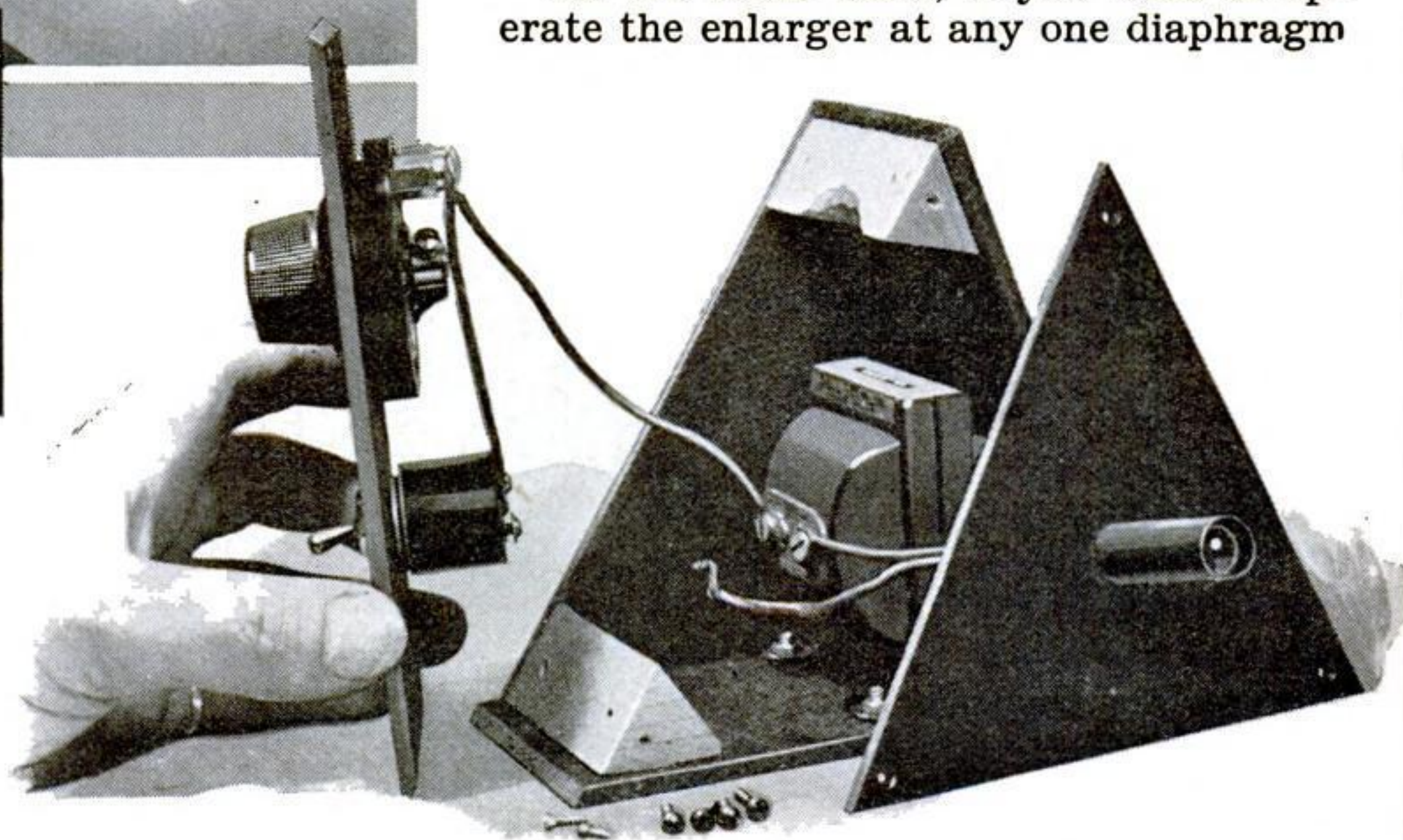
Wiring diagram and, at right, the parts wired and partly assembled. Dimensions are given in the sketch at top of the page, but the exact size is not important

AMATEUR photographers waste an incalculable amount of paper and time when guessing the proper exposure for making enlargements. Worse still, if they guess even slightly wrong, their pictures lack sparkle and brilliance.

Constructed without special tools for less than a dollar, the simple "enlargometer" illustrated gives accurate results. It is merely placed on the enlarging easel so that the extending tube is in the light of the projected negative and therefore casts a shadow on the enlarging easel. A switch is then flicked to light a tiny lamp in the tube so that the easel is illuminated with a soft glow, the strength of which has been set beforehand by means of a rheostat. Next, the iris diaphragm of the enlarger, if it has an adjustable one, is slowly closed until the shadow disappears. At this point, the exposure time will be the same for all negatives.

You can, for example, select an exposure time of five, fifteen, or forty seconds by setting the rheostat beforehand, and then give the same exposure time to all subsequent negatives regardless of their density!

On the other hand, if you wish to operate the enlarger at any one diaphragm

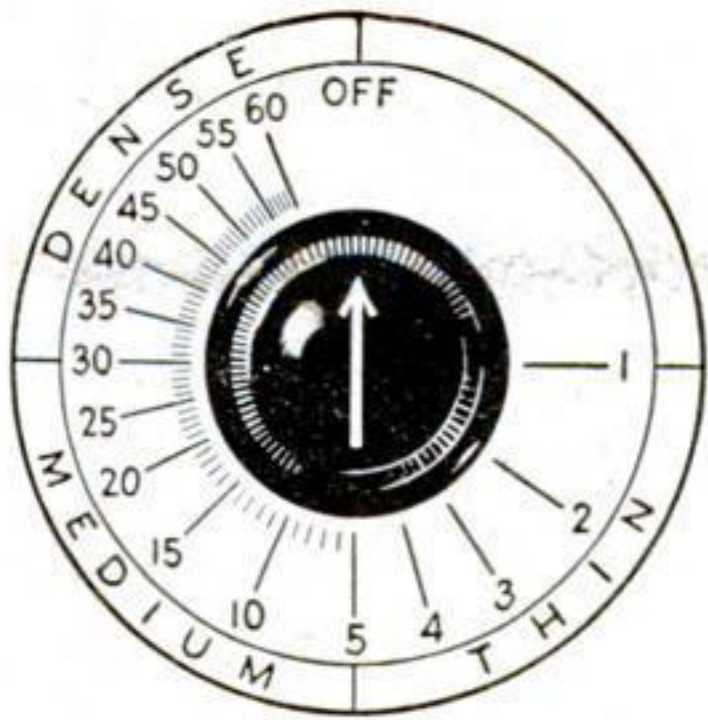


opening or if the diaphragm itself has a fixed opening, it is necessary only to turn the rheostat knob until the shadow disappears. The exposure time is then found by means of a dial placed underneath the knob. In this case the dial positions for different exposures will have to be worked out beforehand, but the scale will remain constant thereafter.

Materials: a piece of 1/8" black tempered pressed-wood composition or other suitable stock for the box; a small radio filament rheostat; 6-volt toggle switch; 6-volt doorbell or radio filament transformer; 6.3-volt radio pilot lamp; a 1 3/4" long piece of black fiber or metal tubing, 7/16" in inside diameter; short extension cord and plug, and some short wood screws and bolts.

Cut the five parts for the housing, bolt the transformer to the bottom, and attach the rheostat and toggle switch to the front panel. Drill a hole in the back piece for the extension cord, which is connected directly to the transformer. Small triangular strips of wood may be fitted in each corner of the housing so that it can more conveniently be screwed together.

In one side, drill a hole for the tubing. Cut a 3/4" by 3/16" slot in the projecting end of the tubing as shown. The pilot lamp can be connected by soldering one of the leads to the center contact; the other lead is then



Rheostat dial for taking the readings in seconds

held in contact with the shell when the lamp is pushed into the tubing. The slot should face downwards so that the light is projected in a narrow beam. The end of the tubing need not be closed.

In case it is necessary to compensate for a low-range rheostat or a low-power lamp in the enlarger, a spring sleeve may be fitted tightly over the end of the tube as shown below at right for reducing the width of the slot.

A 6-volt filament rheostat from an old-time radio will control the pilot bulb over its entire range, but if any difficulty is experienced in obtaining one, you can use a modern low-resistance rheostat by removing the old wire and replacing it with some of higher resistance. Wire from an old radio resistor will do. It should be wound in place evenly so that the dimming action will not be jumpy.

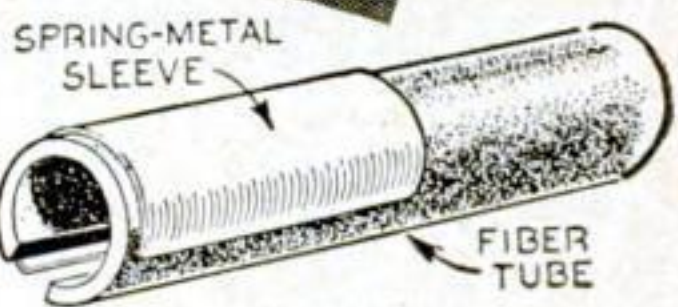
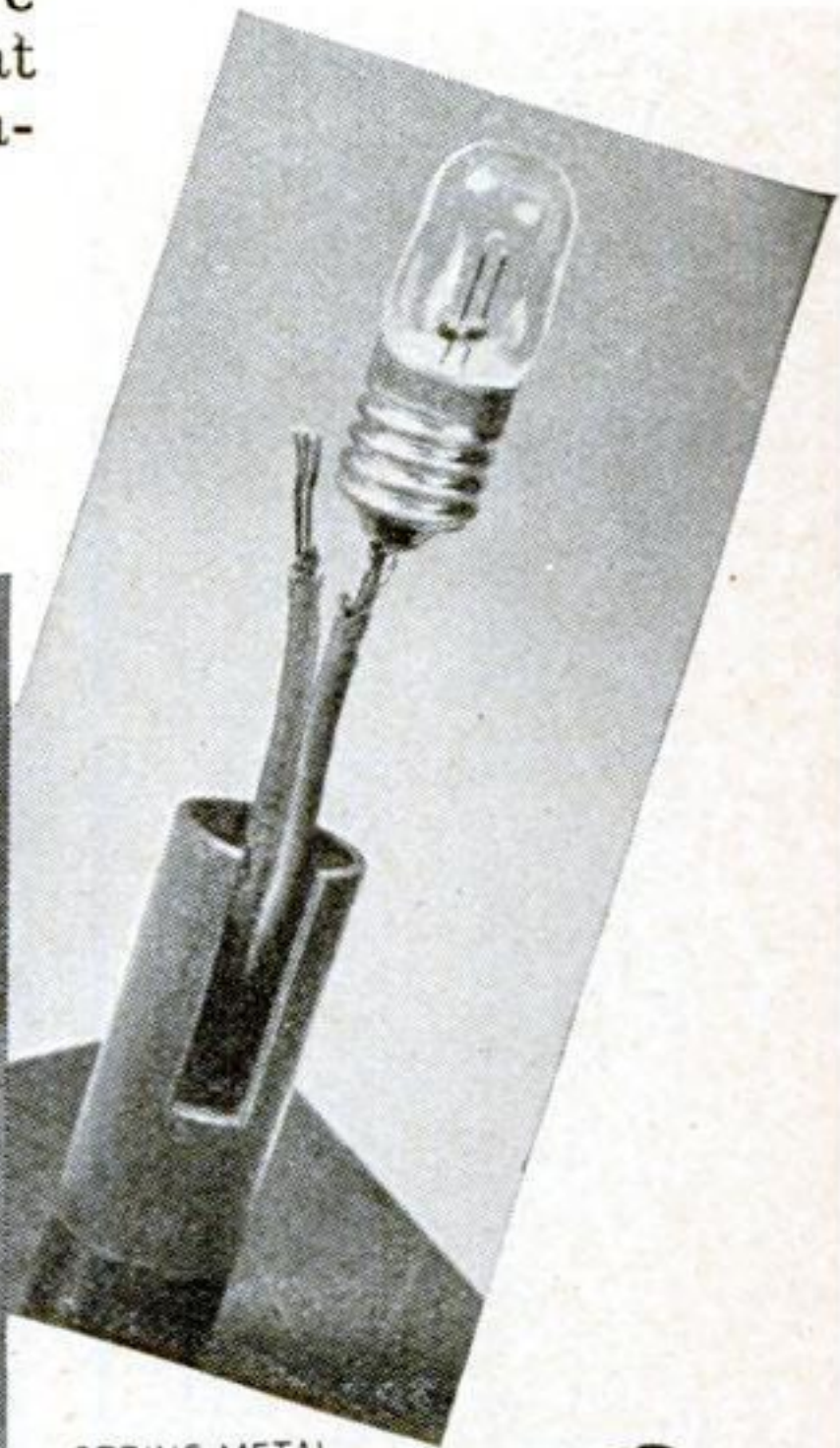
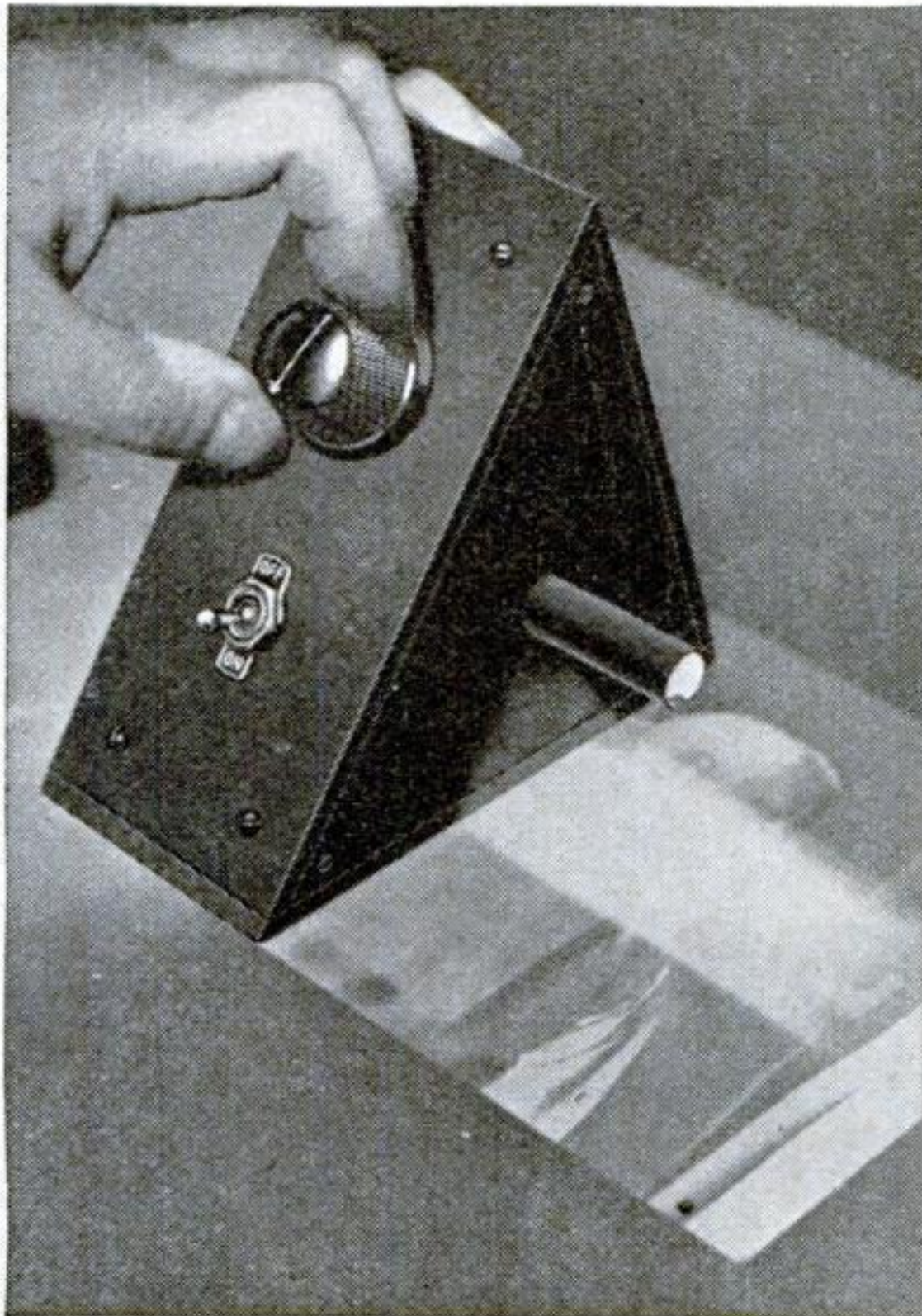
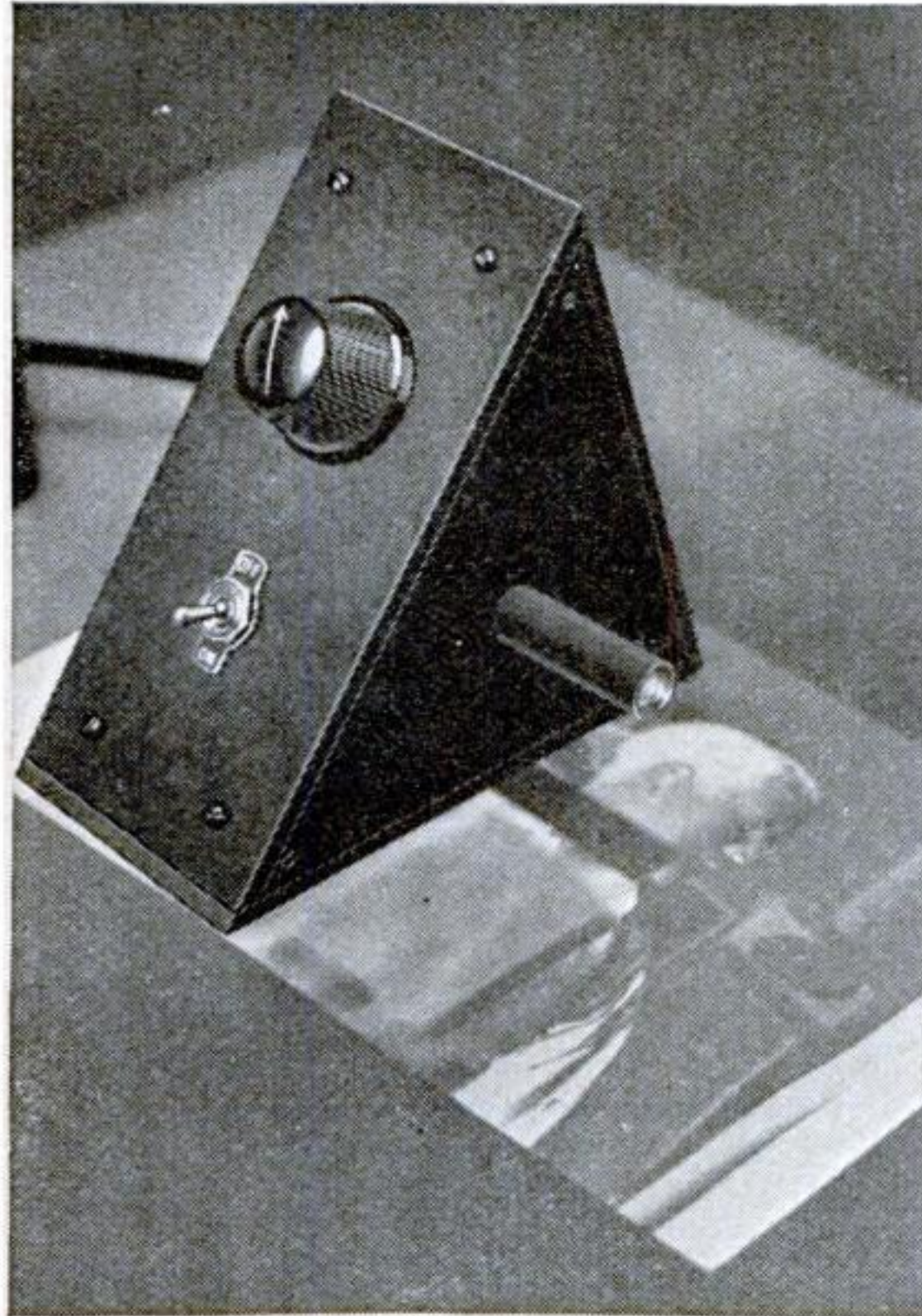
Plug the enlargometer into any 110-volt a.-c. circuit and use the toggle switch for turning it on and off. For the first trial and for setting the rheostat permanently, you will need a negative for which you have found exactly the correct exposure time by careful experiment.

Let us assume that the negative will require a five-second exposure at F/8. Set the lens dia-

HOW THE "ENLARGOMETER" IS SET THE FIRST TIME

The meter is placed so the tube casts a strong shadow across the projected image

By means of the rheostat, the light is then adjusted until the shadow vanishes



The light slot may be cut down in width if necessary by adding an adjustable sleeve. Above, the lamp ready to slip into the tube

phragm at this opening and place the meter on the easel so that the projecting tube casts a strong shadow. Now flip the switch and manipulate the rheostat knob until the pilot lamp casts a soft glow on the easel. The shadow will still be visible, but less strong. Turn the knob farther. At one point the shadow will disappear, and the rheostat is then set properly for use with any negative and a five-second exposure.

With other negatives, simply place the meter on the easel and close the enlarger lens diaphragm until the shadow cast by the projecting tube just disappears. A five-second exposure will then be exactly right.

If you wish to use the lens at a smaller aperture, double the exposure for each smaller aperture opening.

When it is desired to use the second method previously mentioned, a dial may be cemented underneath the knob and calibrated in seconds. Such a dial is illustrated, although the calibrations will have to be worked out individually because of different

conditions encountered in each case. These include (1) strength of enlarging light, (2) lens aperture, (3) degree of enlargement when making tests for calibration, and (4) resistance of the particular rheostat used. Thin, medium, and dense negatives should be tested. In each case, note on the dial the point where the shadow disappears and mark it with the correct exposure. In-between points may then be divided off. A few test exposures with other negatives may be made to check accuracy. Barring current fluctuations, the dial will then show correct exposures in seconds without fail.

It is understood, of course, that the predetermined exposures are for use with one grade of enlarging paper. They will have to be decreased or increased when other grades are used. A "soft" grade will require approximately one-fourth less exposure time than the "normal" grade. For the "hard" grade, increase exposure by one fourth, and for "extra hard," slightly more than twice the exposure time will be necessary.

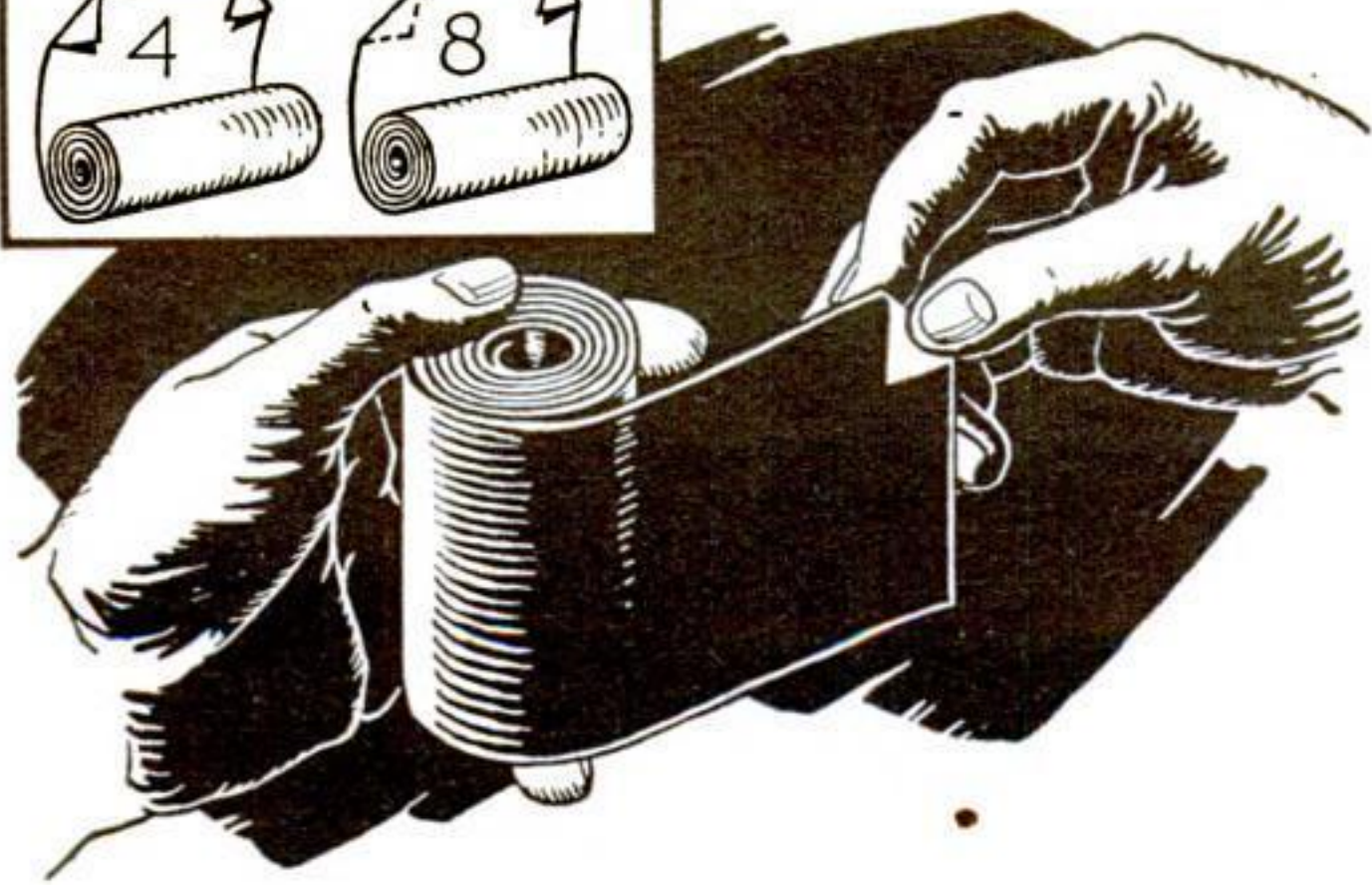
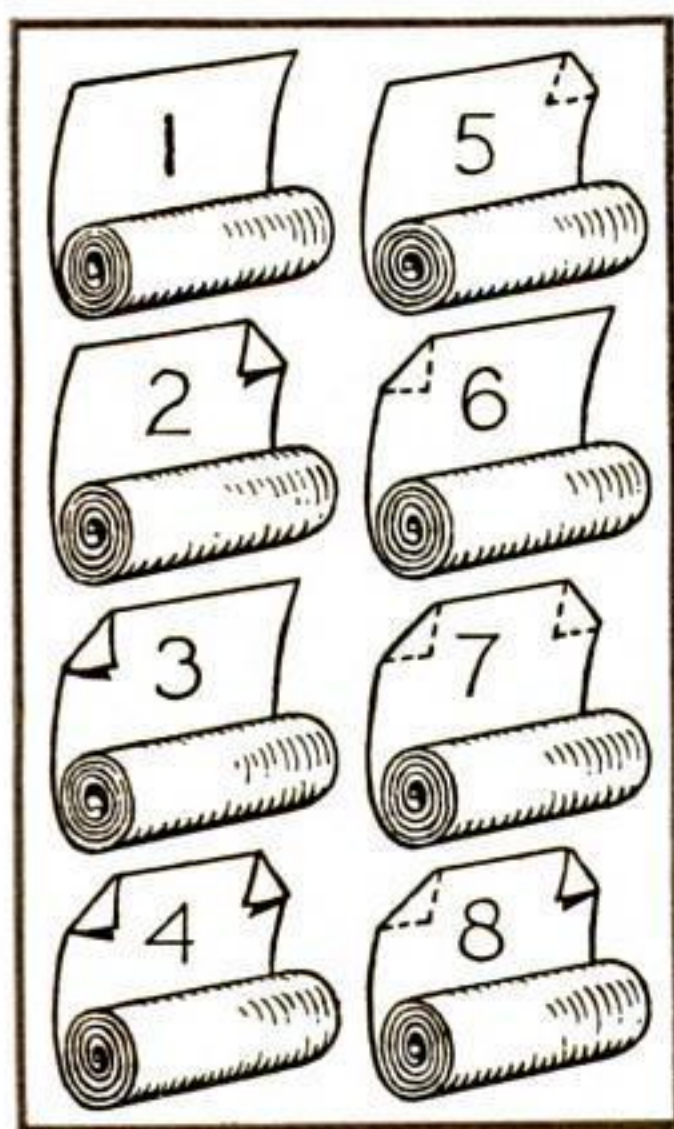
Keeping Track of Roll Films in the Developer

WHEN many rolls of photographic films have to be developed in absolute darkness, there is always a chance that you will not take them out of the developer in the same order they were put in, thus perhaps overdeveloping one and underdeveloping another. A simple way to mark them in the order they are put into the developer is to leave the first

roll as it is; then fold toward you about $\frac{1}{4}$ " of the right corner of the second roll (holding the film so that it curls toward you with the end uppermost) and crease it well; next fold forward the left corner of film No. 3, and both corners of No. 4. If there is a fifth

roll, fold the right corner backward; No. 6, left corner backward; No. 7, both corners backward; No. 8, right corner forward and left corner backward.

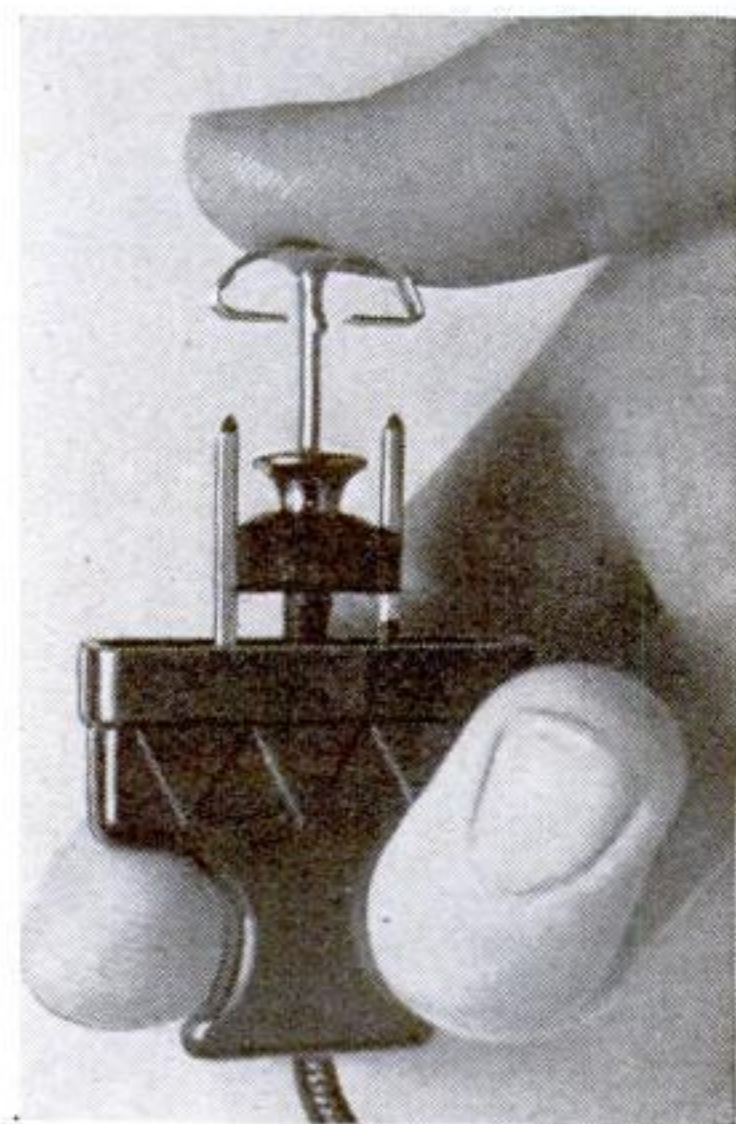
By the time the first five or six rolls have been put into the developer, one by one, the first is usually ready for washing and fixing, so one can then repeat the numbering system.—W. EDWARDS BROWN.



Photoflash Synchronizer Made from an Electric Plug

THIS synchronizer for battery-operated photoflash lamps, which will work at shutter speeds of $\frac{1}{25}$ or $\frac{1}{50}$ second, is made from an electric plug, a thick fiber faucet washer, and a piece of spring brass soldered to the plunger of the cable release. The washer is merely wedged between the prongs

and its center hole enlarged. The spring brass is bent as shown before being soldered to the top of the plunger. Small, flexible, rubber covered lamp cords are attached to the terminals.—HAROLD A. SOARD.





Wax Paper Gives Luster to Matte Prints

PHOTOGRAPHIC enlargements that are to be displayed in an album or mounted for framing or exhibition purposes are frequently made on matte or semimatte paper, but sometimes the prints look rather flat and dull. This may be remedied by rubbing them thoroughly with crumpled wax paper of the type used for wrapping sandwiches. Turn the paper occasionally to produce a new film of wax. The coating not only gives a soft luster, but also prevents the surface from becoming soiled so quickly if the prints are handled often.—B. G. SWITZER.



Solutions Mixed with Aid of Glass Marbles

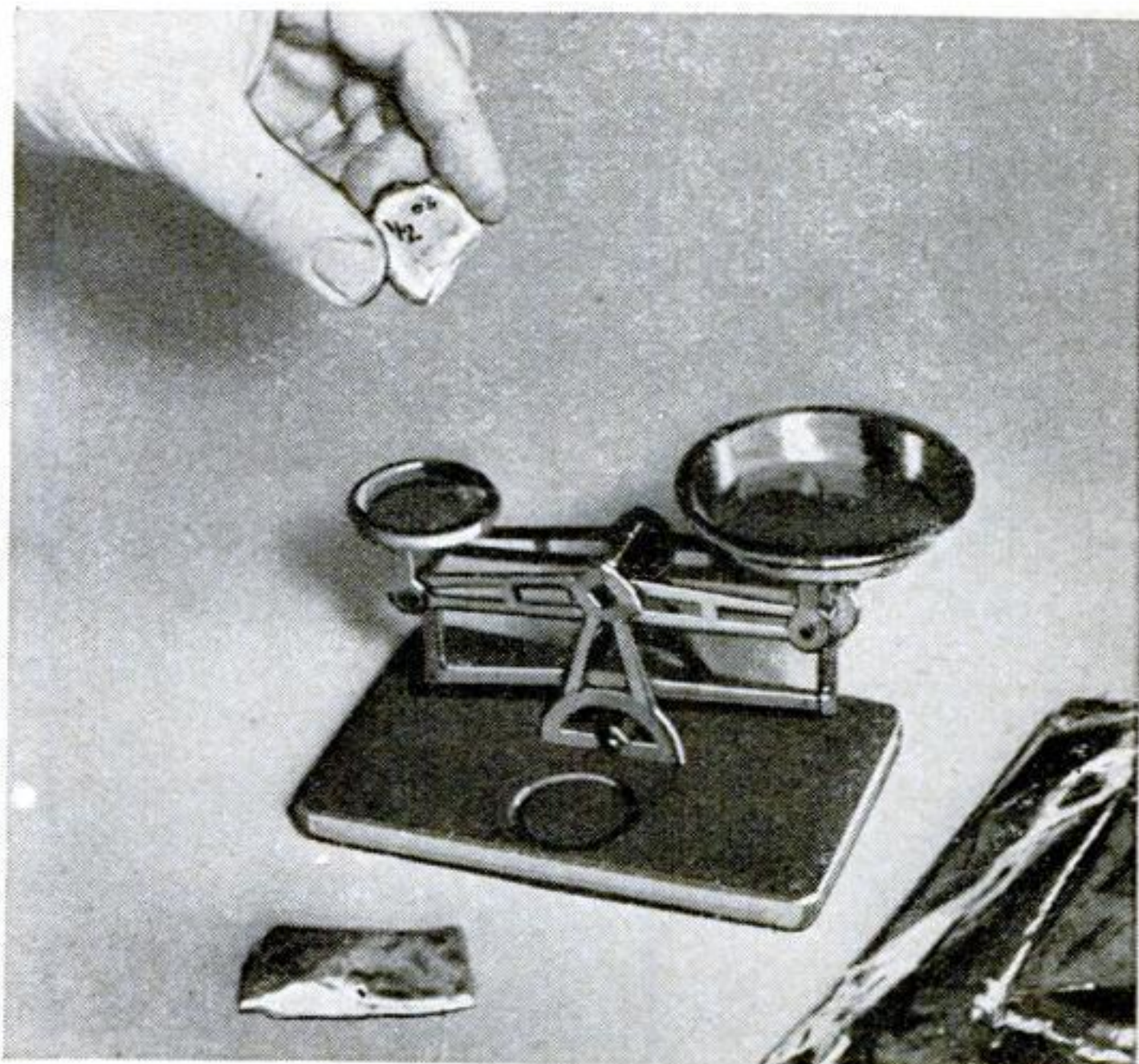
SOLUTIONS that are hard to mix and normally require a lot of shaking to get them ready for use, can be prepared more easily if a few small glass

marbles are dropped into the bottle. The marbles may be left in until the contents have been used up.—A. H. W.

Photostats Mounted Smoothly with Ordinary Paste

PHOTOSTATS, blueprints, and original drawings may be mounted on heavy board without showing wrinkles if the following method is used:

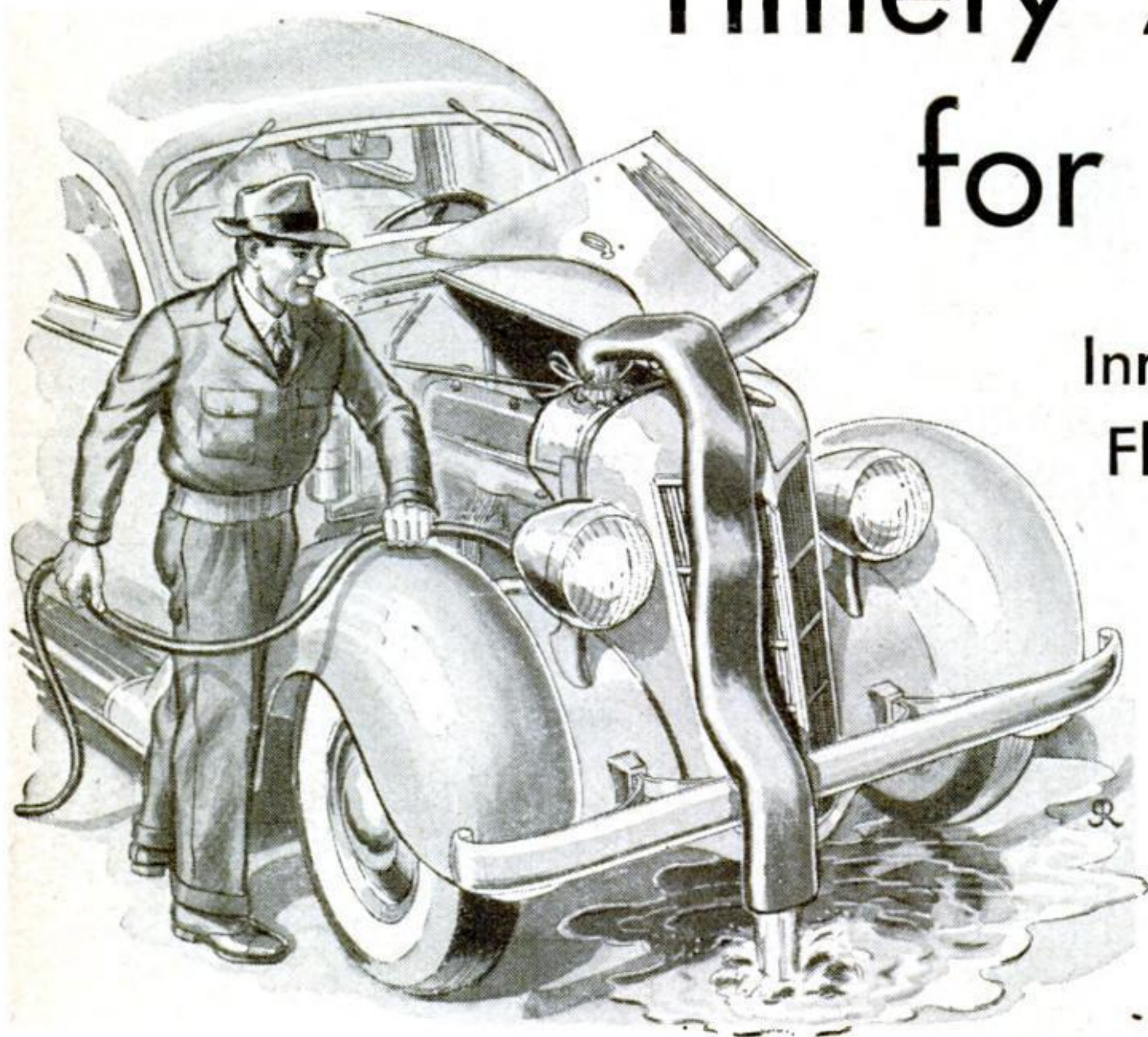
Dilute a first-class grade of stationer's paste with water so it will run, and with a sponge carefully apply this to the back of the drawing and also to the mounting board. See that there are no puddles of liquid paste on either surface. Then lay the sheet gently on the board so its center lies flat, and slowly let it cover the board. With a stiff brush, smooth the finished surface from the center to the four sides. Let it dry slowly, and it will come out free of wrinkles and surprisingly flat.—JAMES F. SCHINDLER.



Special Chemical Weights Made from Tin Foil

TO FACILITATE mixing photographic chemicals and other formulas, special weights can be made from tin foil to supplement those provided with the scales. Crush the foil to a convenient shape, check it with a standard weight until it balances, and mark it clearly. Weights of $\frac{1}{4}$, $\frac{1}{2}$, and 1 oz. will be found useful. If you mix certain formulas repeatedly, weights can be made for each chemical, as, for example, one of 2 oz. 10 grains or 5 oz. 55 grains. Experience will show which sizes to make.—E. J. EISENMEIER.

Timely Aids for Motorists

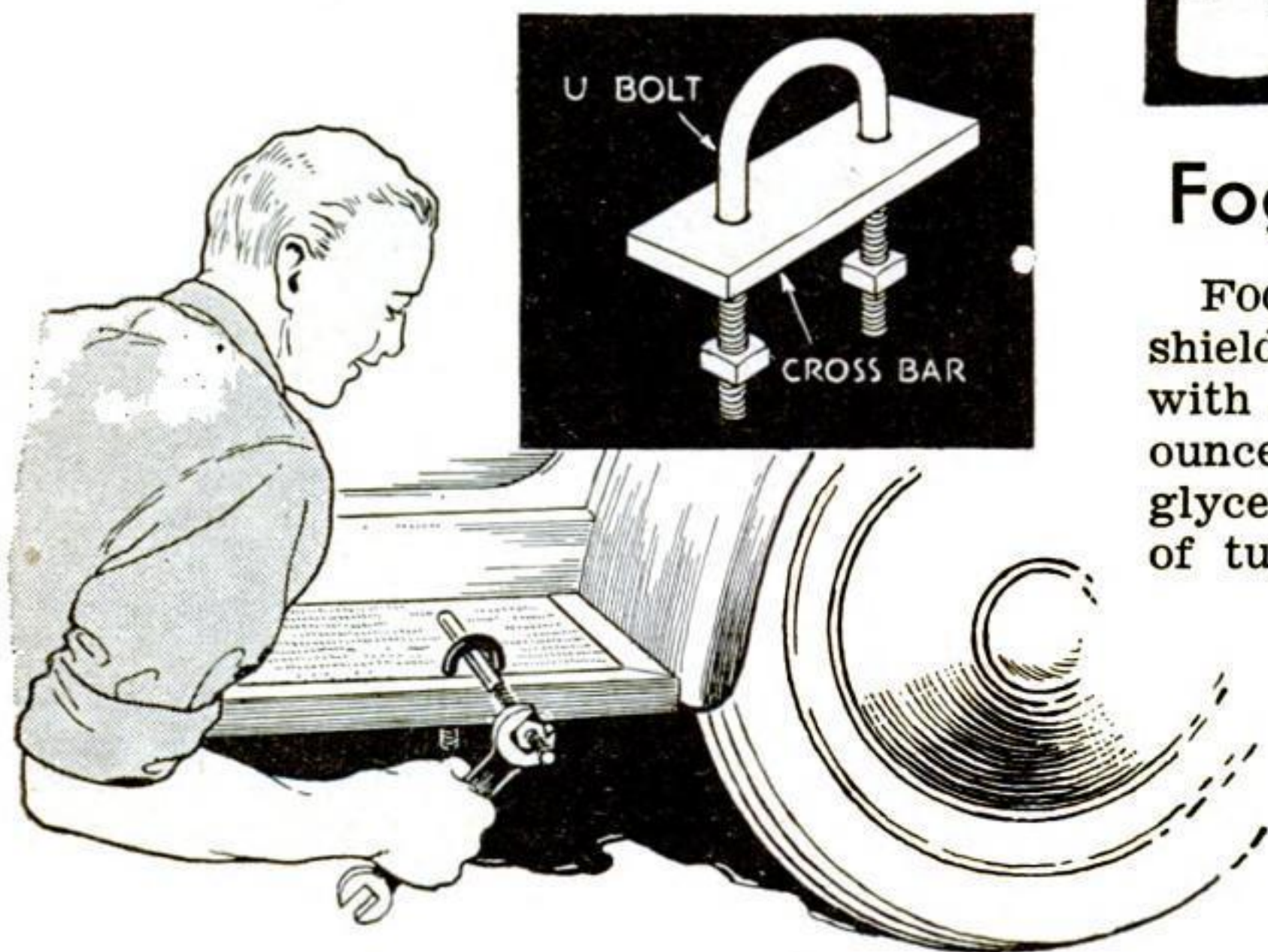


Inner Tube Aids in Flushing Radiator

BY TYING an old inner tube as shown at left to the radiator cap, you can prevent rusty radiator water from spilling out and staining a car's finish when the cooling system is being flushed out from the lower radiator connection.—A.H.W.

Vise for Minor Repairs

MINOR automobile repairs on the road are facilitated by the improvised vise shown in use below. Two holes drilled through the edge of the running board accommodate the U bolt, as indicated in the inset.—B.I.



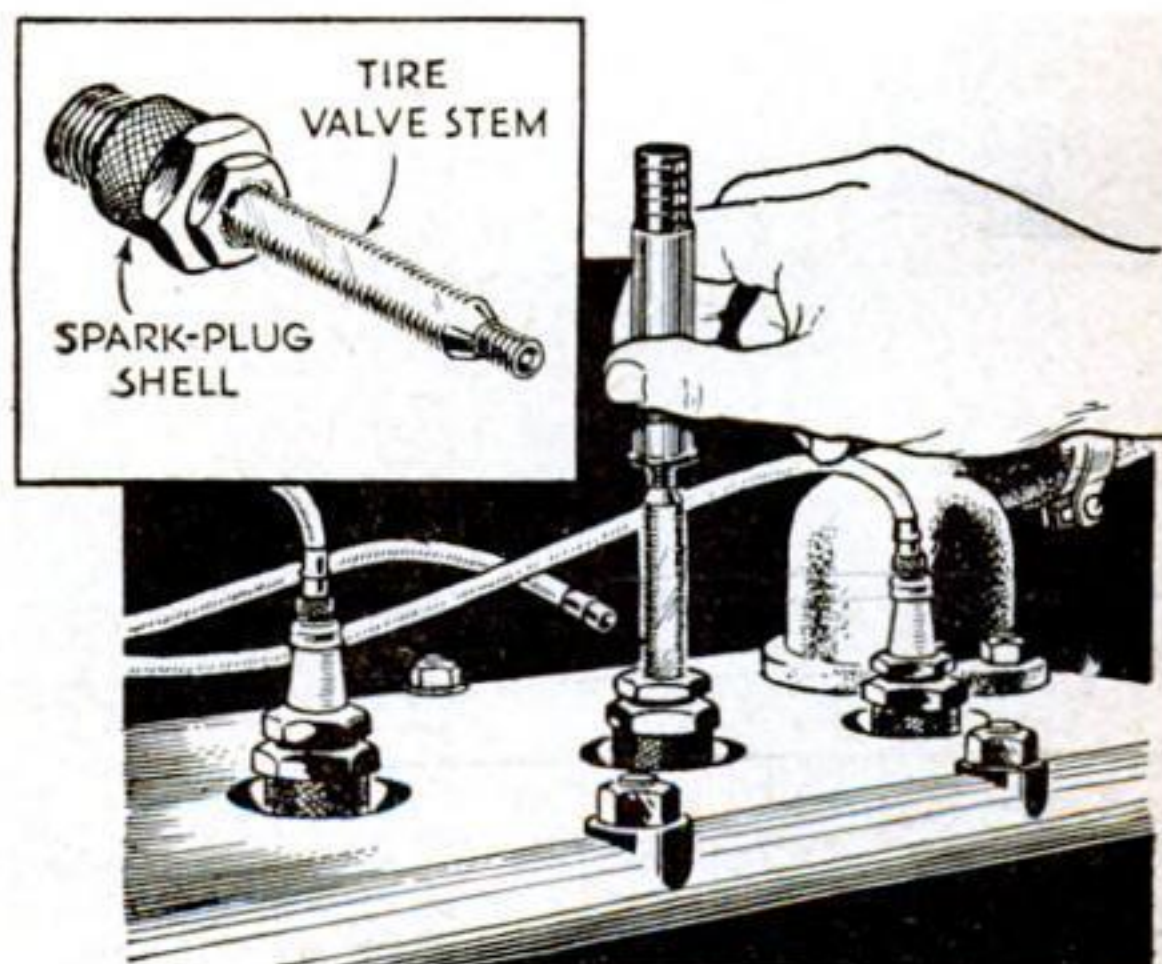
Tire Gauge Measures Compression

A TIRE valve stem soldered into an old spark-plug shell makes it possible to check cylinder compression simply by inserting the shell in place of a regular plug and pressing a tire gauge over the valve stem. A low reading on the gauge may mean piston-ring or valve wear.—H.A.



Fogproofing a Windshield

FOGGING of the inside surface of a windshield can be prevented by wiping the glass with a sponge dipped in a mixture of four ounces of potassium oxalate, two ounces of glycerin, one grain of camphor, and one ounce of turpentine. Heat as shown.—M.L.



Here's a Real "POWER HOUSE" for your Car!



A NEW BATTERY

THAT LASTS 68% LONGER!

New type Willard Thread Rubber Insulators and Willard High Quality plates give the Willard "H-R" top performance and a life 68% above the average of over 100 other brands, including all the best known makes

● It really IS an individual power house—this new Willard "H-R" Battery.

It feeds electricity to your starter, your ignition system, your car radio, your horn, your lights, and other current consuming devices whenever it is needed—regardless of weather conditions.

Almost any battery built, will probably do that—at first.

But *here's* the difference—the Willard "H-R" does all the things a battery is supposed to do—and it keeps on doing them for 68% longer than the average of competing batteries.

Your Willard dealer will be glad to show you the new "H-R" and explain its many advantages. If your present battery is old or showing signs of weakness, install a new "H-R" now *before* you "get stuck."

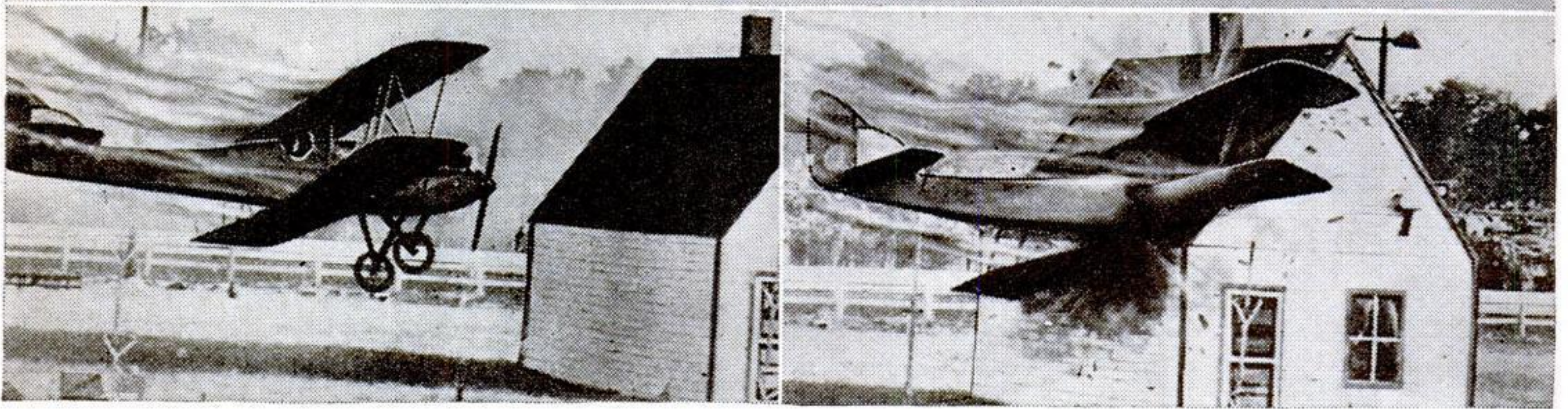
WILLARD STORAGE BATTERY COMPANY • Cleveland • Dallas • Los Angeles • Toronto

ASK FOR IT BY NAME AT

**The WILLARD
H-R**

YOUR WILLARD DEALER'S

Crashing a plane through



"SHOT DOWN IN FLAMES, you crash into a house..." That is actually what aerial warfare movie scripts demand of Stunt Pilot Frank Frakes. But up he goes, his plane's wings soaked in gasoline. High in the sky, he touches off

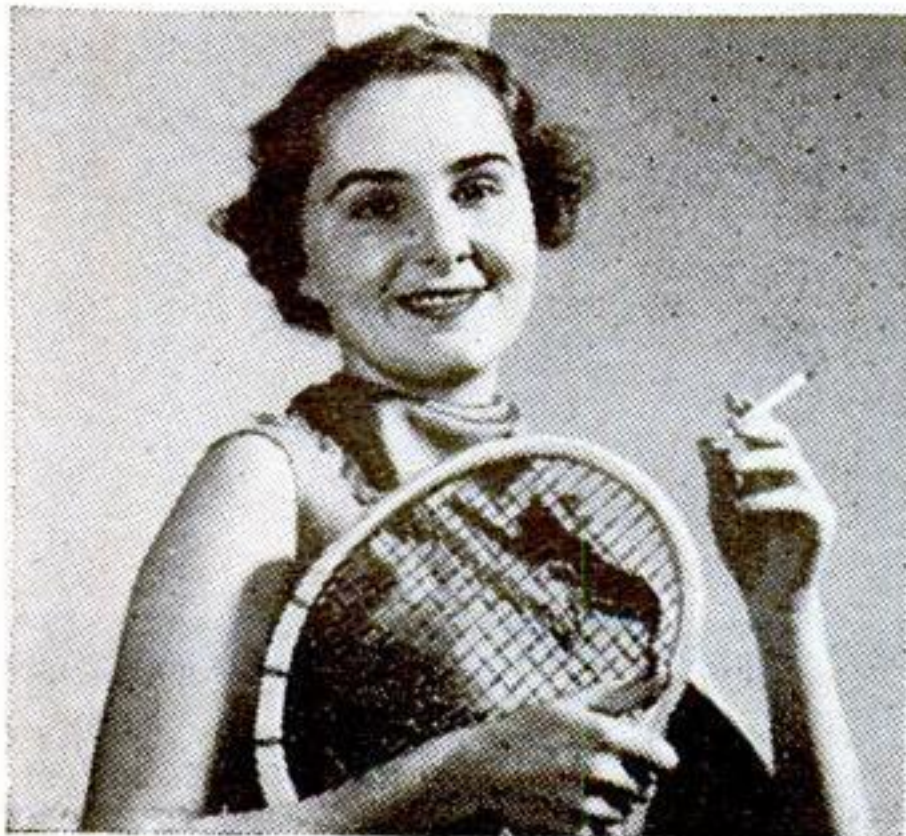
electrical sparks, swoops down ablaze in a roaring power-dive. Leveling off (Picture 1), he heads straight for the spectacular crack-up that thrills even hardened movie directors. Will Frakes come through that house alive? He's

**"NATURALLY I'M PARTICULAR
ABOUT THE CIGARETTE I SMOKE,"**

SAYS STUNT PILOT FRANK FRAKES—

**"CAMELS
DON'T AFFECT MY NERVES
IN THE LEAST!"**

"I'M NOT A CHAMPION," says Miss Henrietta Donohue, "but I'm just as interested in winning at *my* golf, tennis, and swimming. I know the importance of healthy nerves, so Camel's my cigarette. Camels never get me 'edgy.' And Camels give my energy a 'lift' too. They set me right!"



**Camels are a matchless
blend of finer, MORE
EXPENSIVE TOBACCOS
—Turkish and Domestic**



a house!

Pilot Frank Frakes' most spectacular feat — the stunt that thrills Hollywood and millions of movie-goers —



performed such stunts more than fifty times. **CRASH!** (Picture 2) As he hits with terrific impact, a charge of dynamite is exploded inside the house (Picture 3) to heighten the effect. Wings ripped off (Picture 4), the flaming plane

shoots out — hopelessly **WRECKED!** Frakes? Below you see him safe, smiling, ready to enjoy his favorite smoke — a Camel! "Stunt-flying is exhausting work," says Pilot Frakes. "When I need a 'lift' in energy I get it with a Camel."



I NOTICE THAT YOU ALWAYS SMOKE CAMELS, FRANK. DO YOU FIND CAMELS SO DIFFERENT?

YES — IN MILDNESS, IN TASTE, IN LOTS OF WAYS. BESIDES, STUNT-FLYING DEMANDS HEALTHY NERVES. CAMELS DON'T AFFECT MY NERVES IN THE LEAST — I CAN SMOKE AS MANY AS I WANT. CAMELS AGREE WITH ME IN MANY WAYS — AND OTHER PILOTS SAY THE SAME!

Above, right, Stunt Pilot Frank Frakes tells Gordon Weaver more about why he prefers Camels. It's a preference with a *reason*: Camel's *costlier* tobaccos! And that's the very same reason why so many millions of smokers have turned to Camels. Do *you* want more smoking pleasure — more downright cigarette enjoyment? Make your next smoke the cigarette of costlier tobaccos — Camel!

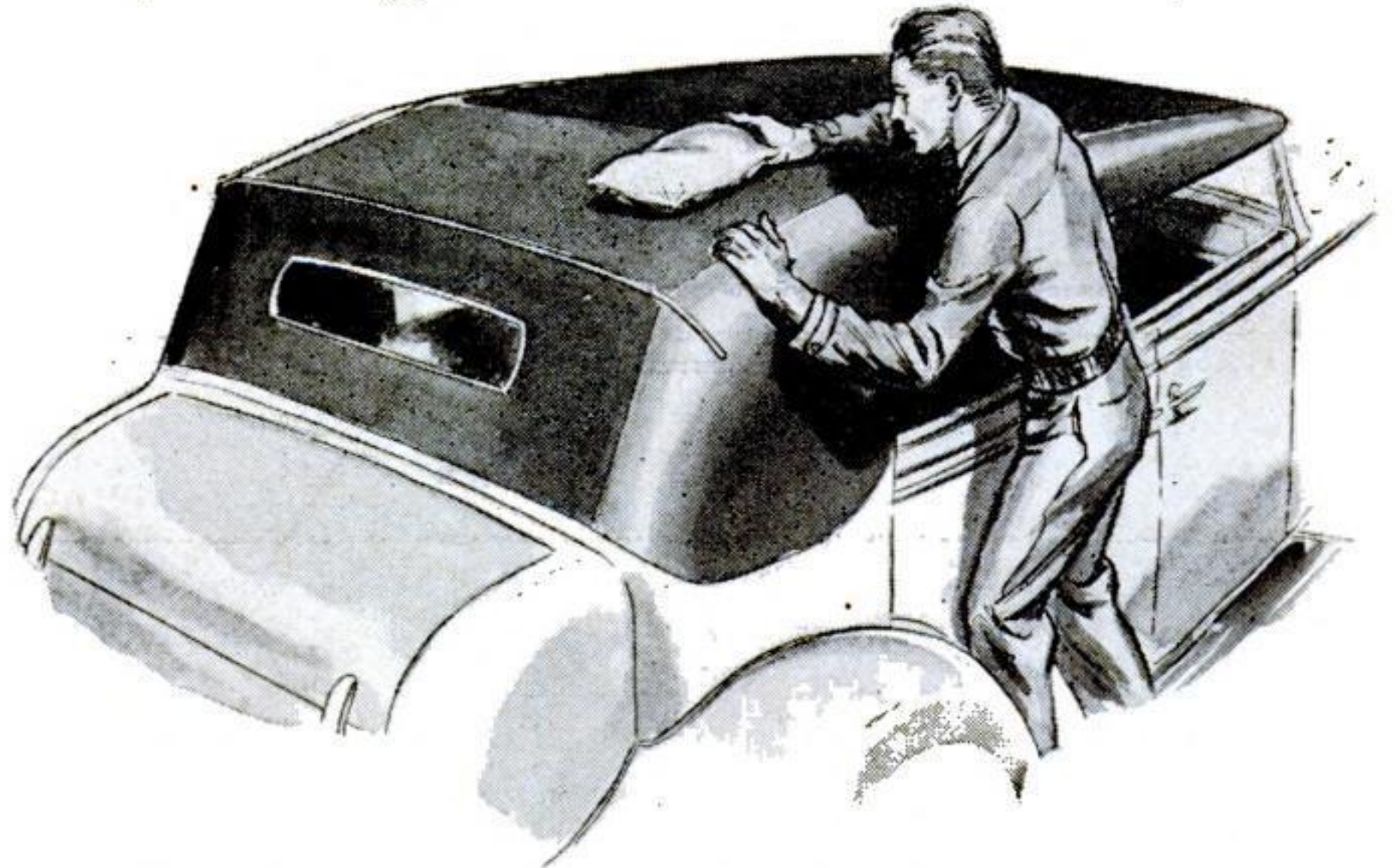
Copyright, 1938. R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

PEOPLE DO APPRECIATE THE COSTLIER TOBACCOS IN CAMELS

THEY ARE THE LARGEST-SELLING CIGARETTE IN AMERICA

Sandbag Aids in Repairing Car's Canvas Top

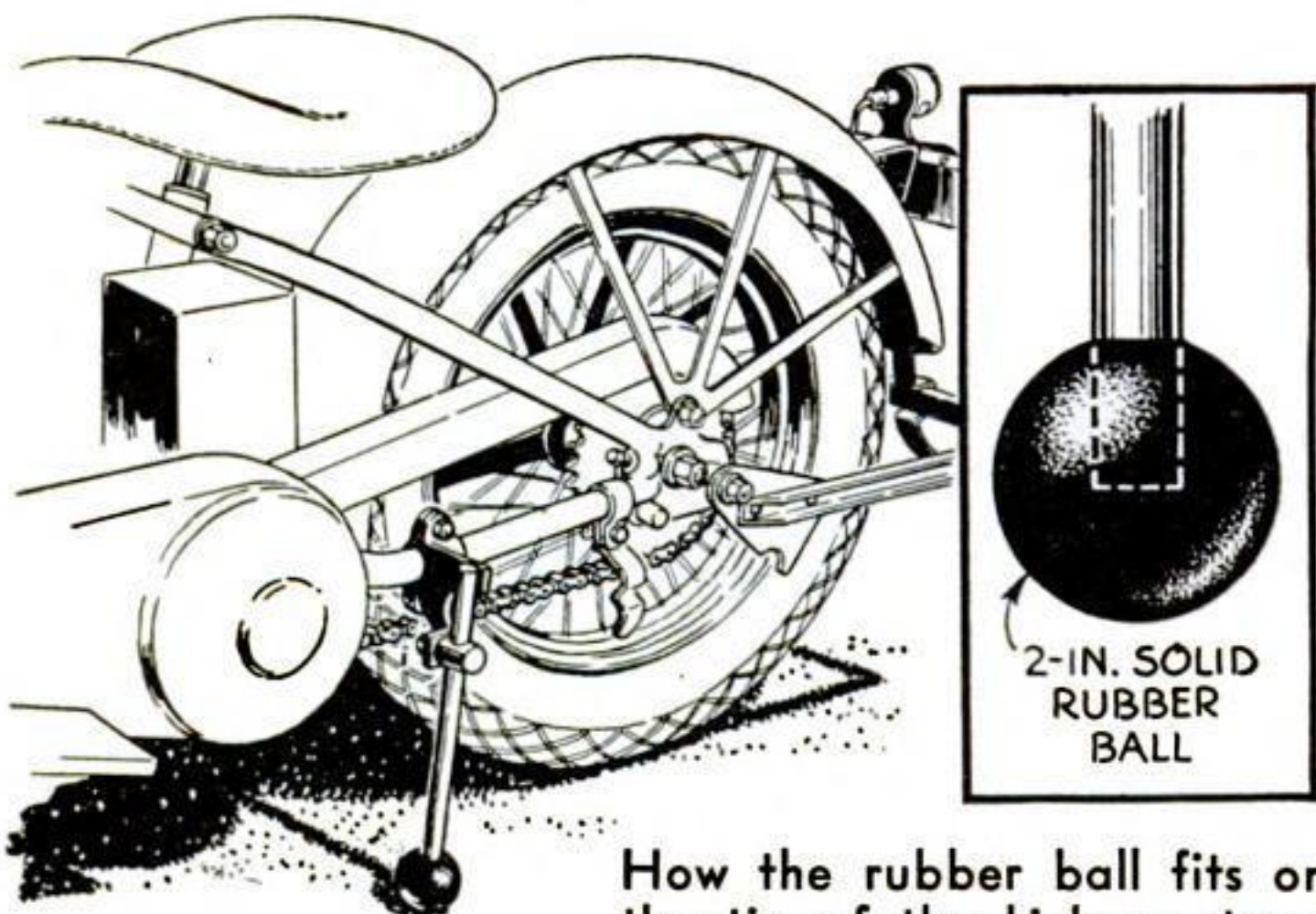
WHEN repairing the fabric top on a convertible or roadster with a cloth patch and an adhesive cement, it is often difficult to get the patch to lie flat while the cement is drying. To make a neat job, partially fill an old sugar or salt bag with sand. Cement the patch in place on the car roof, and lay the sand bag over the patch, leaving it there until the cement is dry. The bag will conform to the shape of the top and hold the patch in place. If the weight makes the fabric top sag, a temporary support can be placed inside the car.—G.H.



Weight of the sandbag keeps a patch flat until cement dries

Solid Rubber Ball Makes Cycle Stand Skidproof

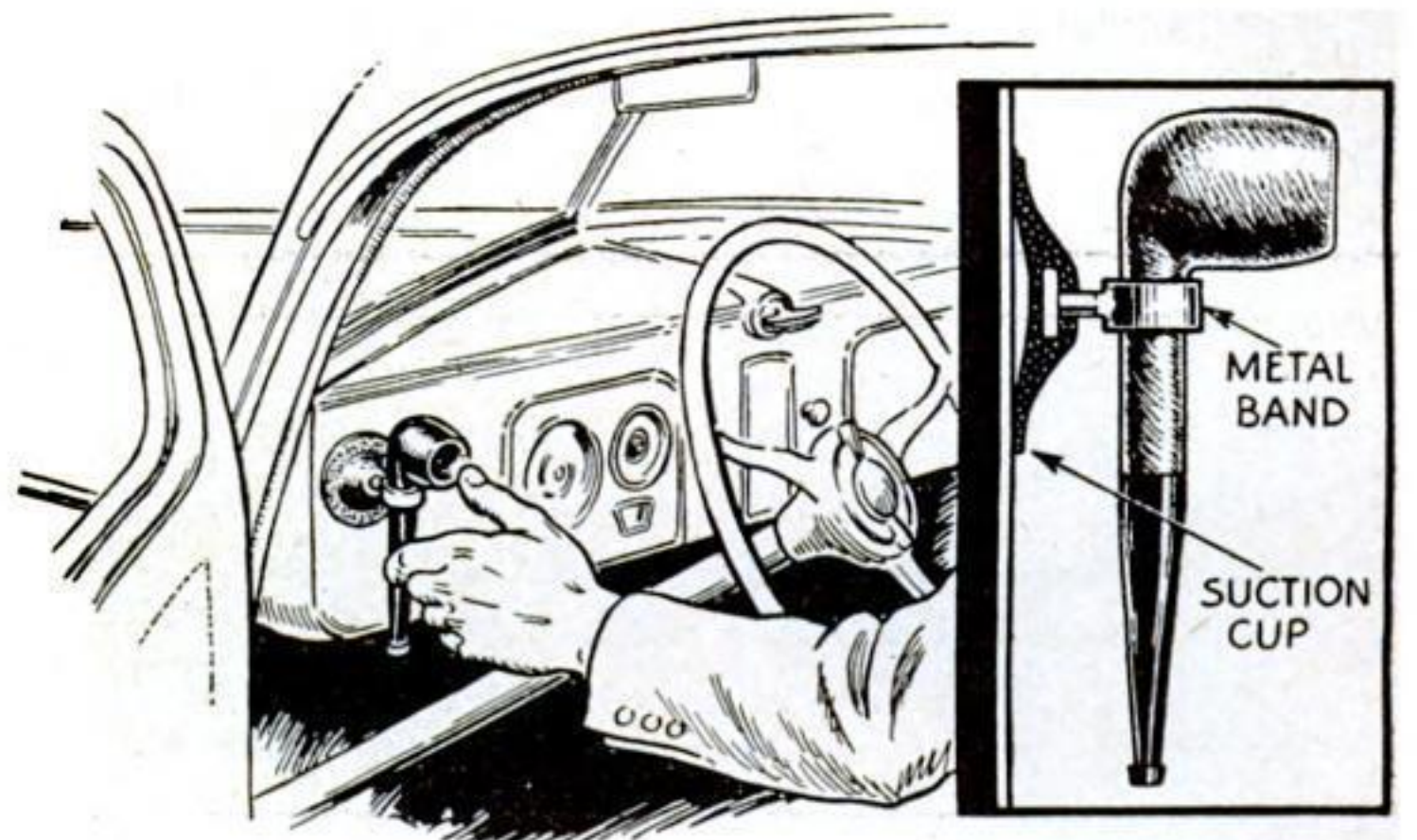
TO PREVENT the kick-up stand of a motor cycle from slipping from under the parked machine, attach a solid rubber ball to the end of the stand as shown in the drawing below. The ball, of the type readily obtainable at most toy or pet shops, should be about two inches in diameter. Drill the mounting hole an inch deep and slightly smaller than the diameter of the end of the stand.—A. H. W.



How the rubber ball fits on the tip of the kick-up stand

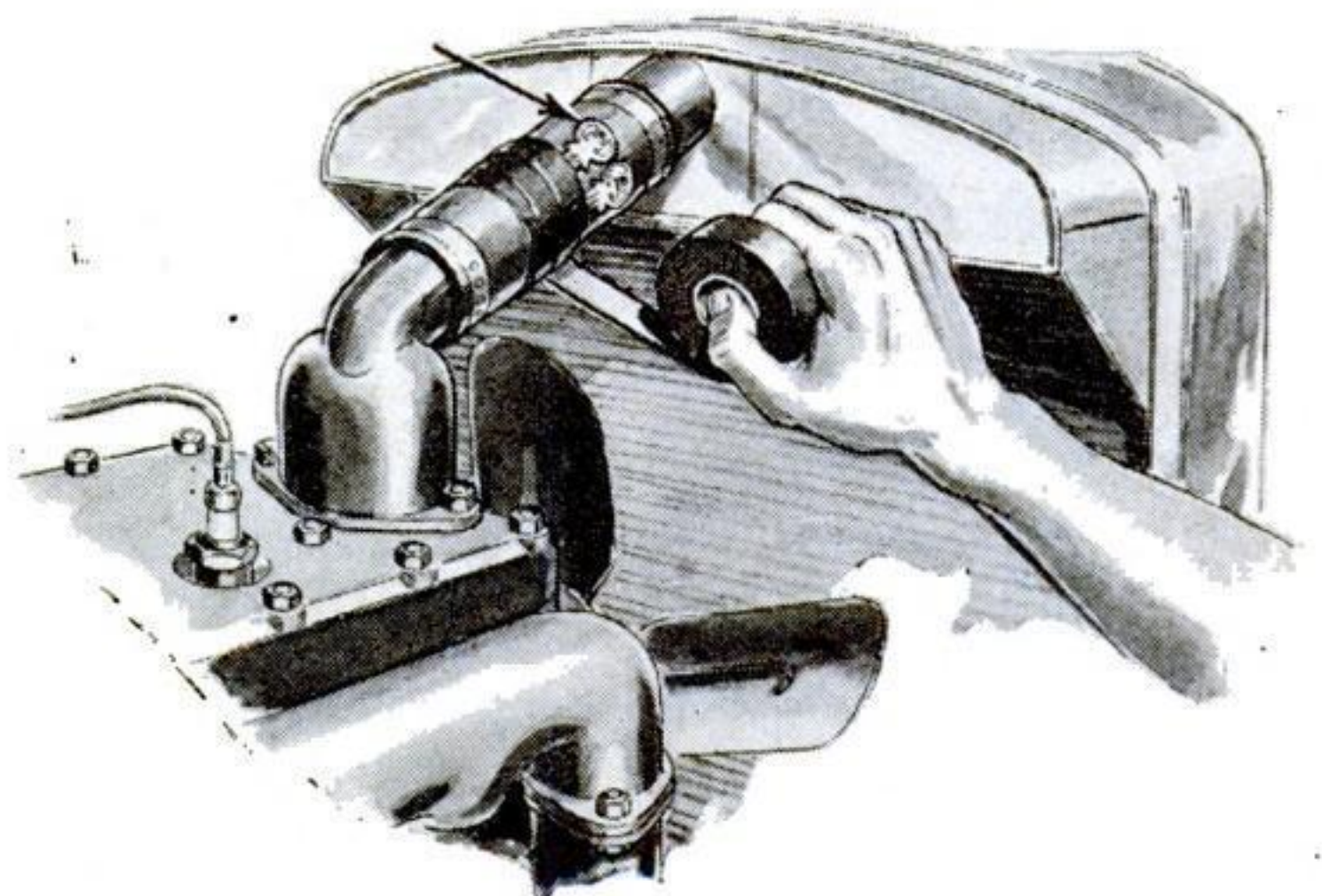
Spare Keys for Car Taped to Radiator Connection

THAT extra set of car keys for emergencies can be well hidden under the car hood. I placed mine flat against the radiator hose and wrapped friction tape around them until they were covered. Now I can neither lock myself out of my car nor be delayed if I lose my regular keys.—W. M. S.



Handy Dashboard Device Holds Driver's Pipe

PIPE-SMOKING motorists can easily provide themselves with the handy dashboard rack for holding pipes as pictured above. Using the rubber suction cup from some discarded ash tray or similar appliance, solder a metal ring to the screw that projects from the cup. Fasten the unit on the dash so that the ring will admit the stem of the pipe, bit downward.—R. T.



Concealing car keys in an inconspicuous place



Stop the hidden gas waste

HAVE YOUR PLUGS CLEANED... 5¢ EACH

As your spark plugs become dirty (coated with oxide, soot, and carbon) they misfire with gradually increasing frequency. The hot oxide coating acts as a conductor and becomes "the line of least resistance" for the electric current.

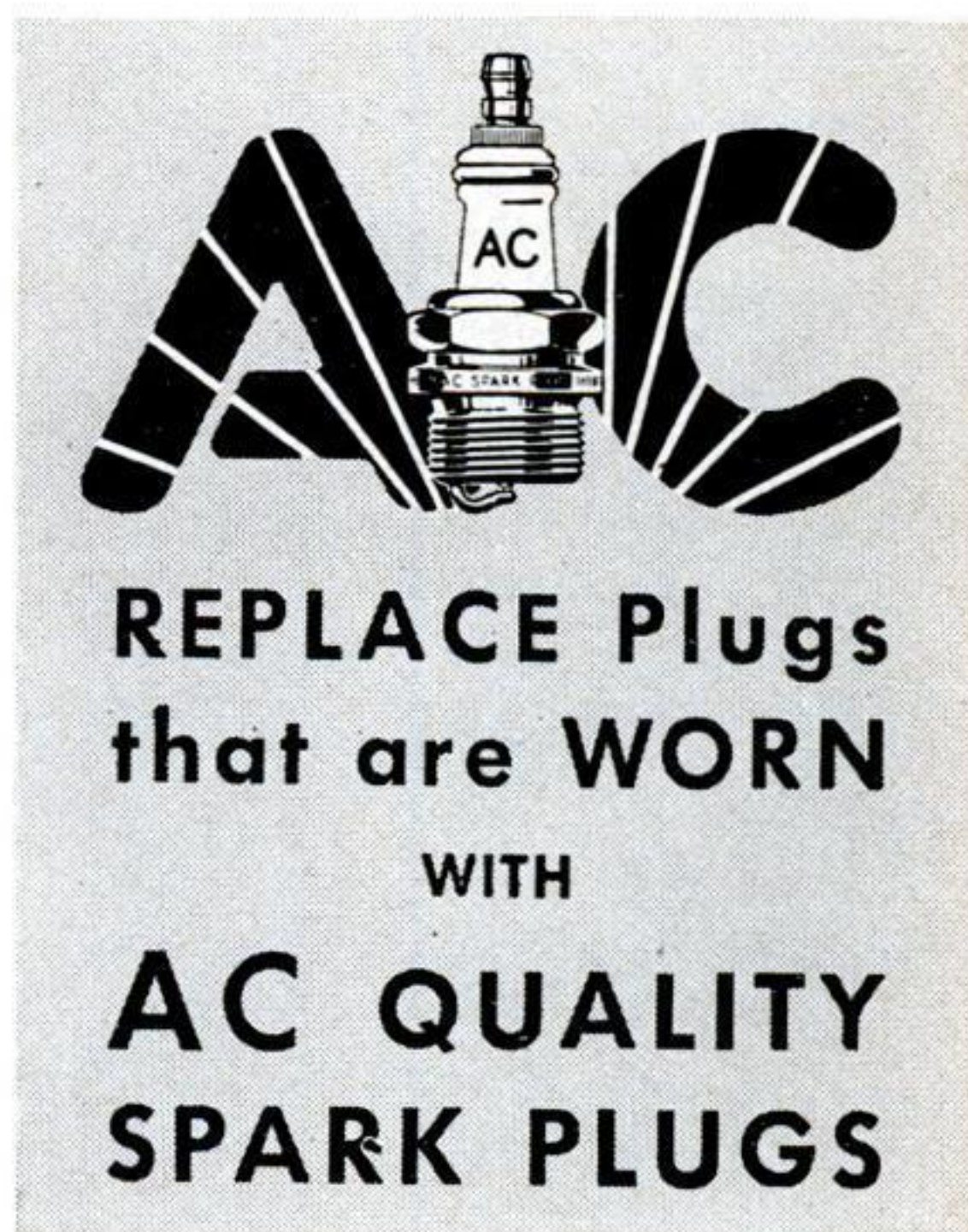
This misfiring is seldom noticeable. Yet, after 4,000 miles of driving, it occurs frequently enough to cause a gas waste of as much as one gallon in ten. It also causes a loss of power, and makes the engine hard to start.

Registered AC Spark Plug Cleaning Stations (there is one near you) are equipped to clean plugs—quickly and thoroughly—while you wait. Visit them *regularly*, every 4,000 miles, and you'll save gas and have a more responsive car.



LOOK FOR THIS SIGN
when you need plugs or plug service.

AC SPARK PLUG DIVISION • General Motors Corporation
FLINT, MICHIGAN





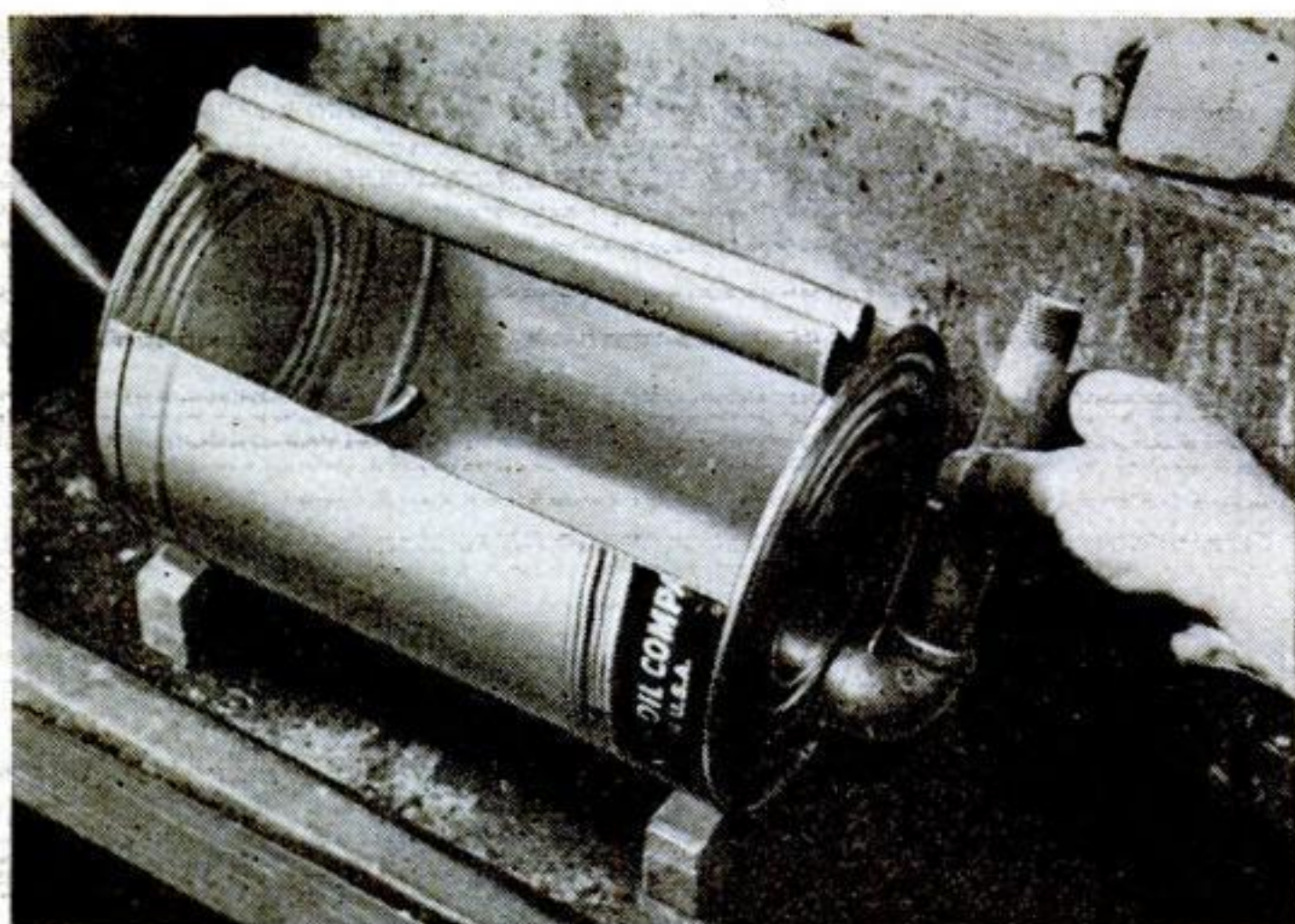
Each flap cut from the can is rolled around a dowel so both together will serve as a handle

side attach a piece of 1" pipe, with an elbow, as an adjustable outlet. Screw two wood rests to what will be the bottom of the washer. The water connection is made by means of a rubber tube, which slips over the input jet and forces the water to circulate.



Automatic Print Washer Made from Oil Can

FORCED into circular movement by water pressure, photographic prints and enlargements up to 5" by 7" are quickly freed of hypo in this automatic print washer. Obtain an empty 5-qt. lubricating oil can and solder the hole. At a point 3" from each side of the seam, cut the tin as shown; then roll the pieces to form a handle. Solder a small piece of copper tubing into one end as an input water jet and bend it on the inside of the can to follow the rounded contour. To the other

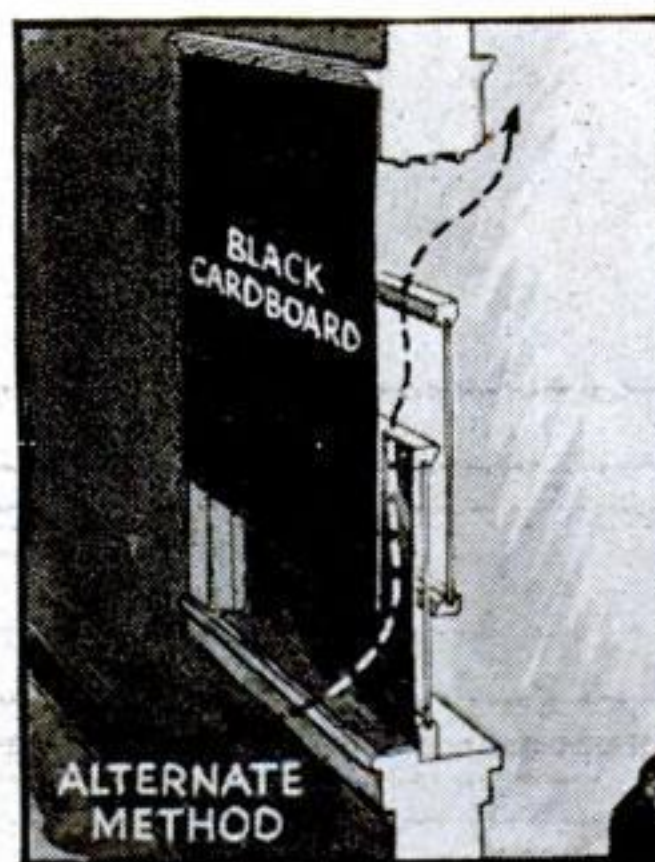


The overflow pipe is adjustable to keep the water at any desired level. Note the curved inlet tube

Darkroom Window Shades

CHEAP black oilcloth on a shade roller slightly wider than the window will keep light out of an improvised darkroom. Across the top and down the sides of the window casing, fasten 6" strips of heavy black cloth so they overlap the oilcloth shade when pulled down. This prevents light leaks around the edges. The bottom can be taken care of either by using another strip of cloth or by slipping the shade rod under two clips that hold it securely against the inside window sill or stool. In case this arrangement, which is nearly airtight, makes the room unbearably hot and stuffy, use the alternative method shown. The upper sash may then be opened about half-way to provide air.

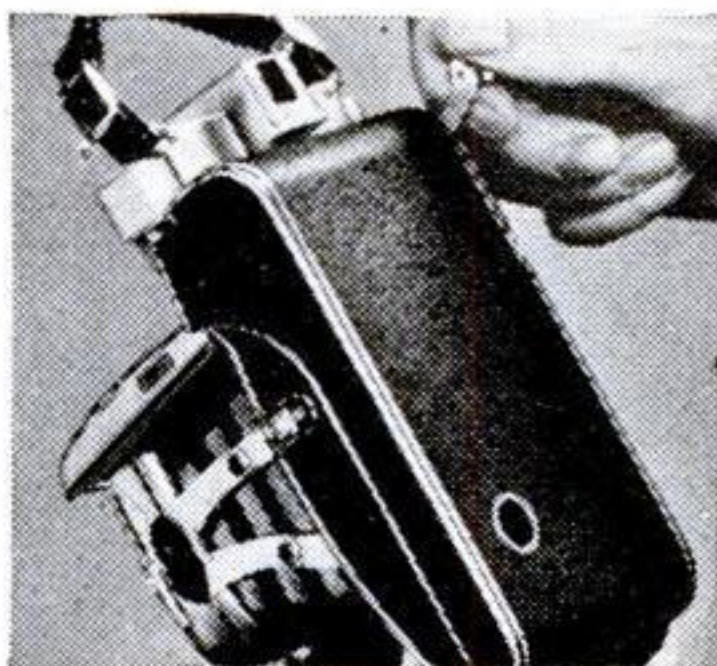
—RICHARD C. BELSER.



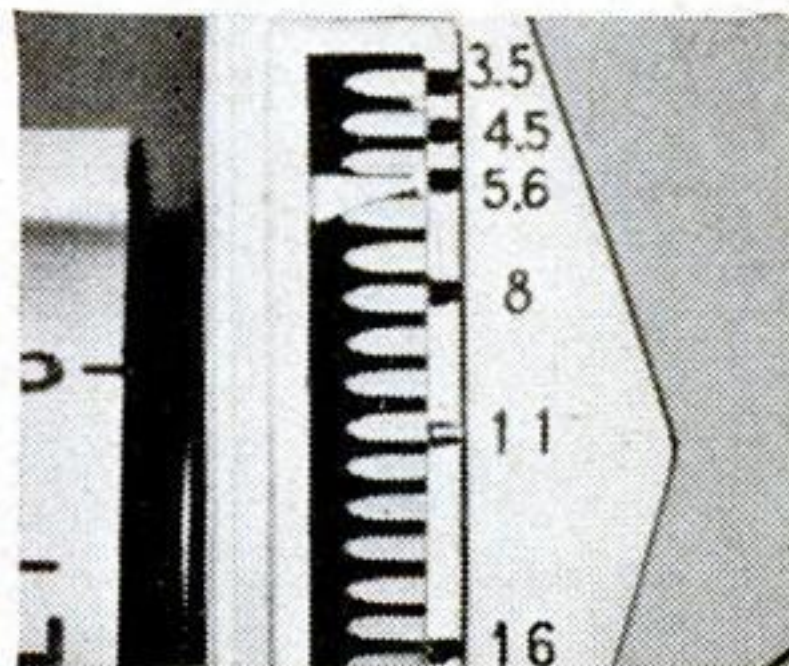


Presenting SUPER KODAK SIX-20

The camera with the "electric eye"



One lever sets the shutter, actuates the window cover, advances the film.



This automatic scale shows the aperture at which the exposure will be made.

The photoelectric cell, mounted behind multiple collective lenses, automatically preselects proper aperture for the picture.

● Built-in photoelectric cell measures light and sets camera at correct "stop" for any hand-held shutter speed. Built-in range finder. Double-exposure prevention device. Shutter

set by film-winding lever. Has Kodak Anastigmat Special $f.3.5$ lens, $1/200$ shutter, fine-camera equipment throughout. Pictures, $2\frac{1}{4} \times 3\frac{1}{4}$ inches. Price . . . **\$225**

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● A "miniature" to suit every purse. The special $f.4.5$ and $f.5.6$ models take Kodachrome as well as black-and-white.

Kodak Bantam Special has extra-fast, super-corrected lens, Kodak Anastigmat EKTAR $f.2.0$. $1/500$ -second Compur-Rapid shutter. Built-in coupled range finder, split-field military type. Film-centering device. New low price includes field case.

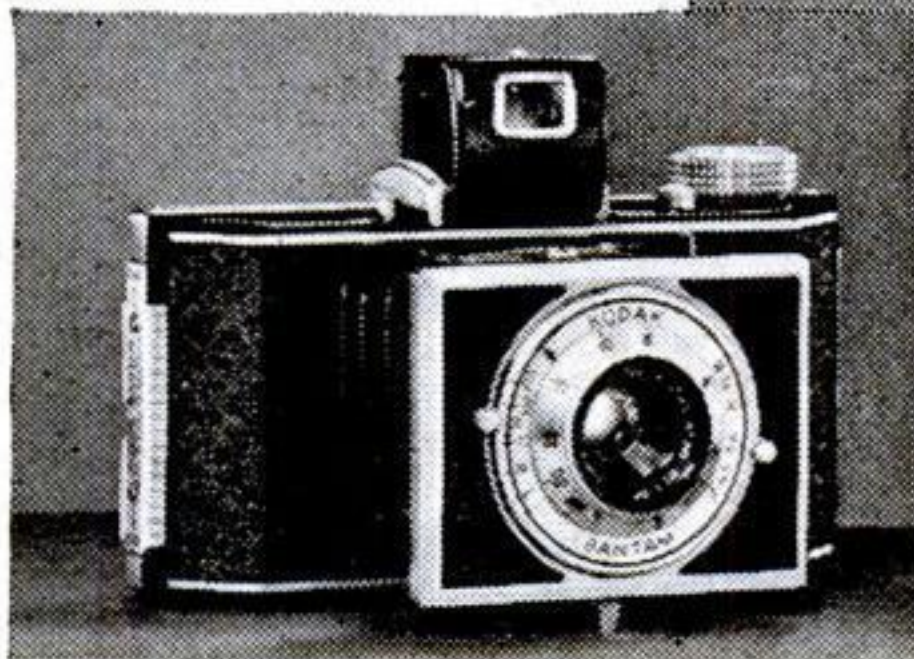
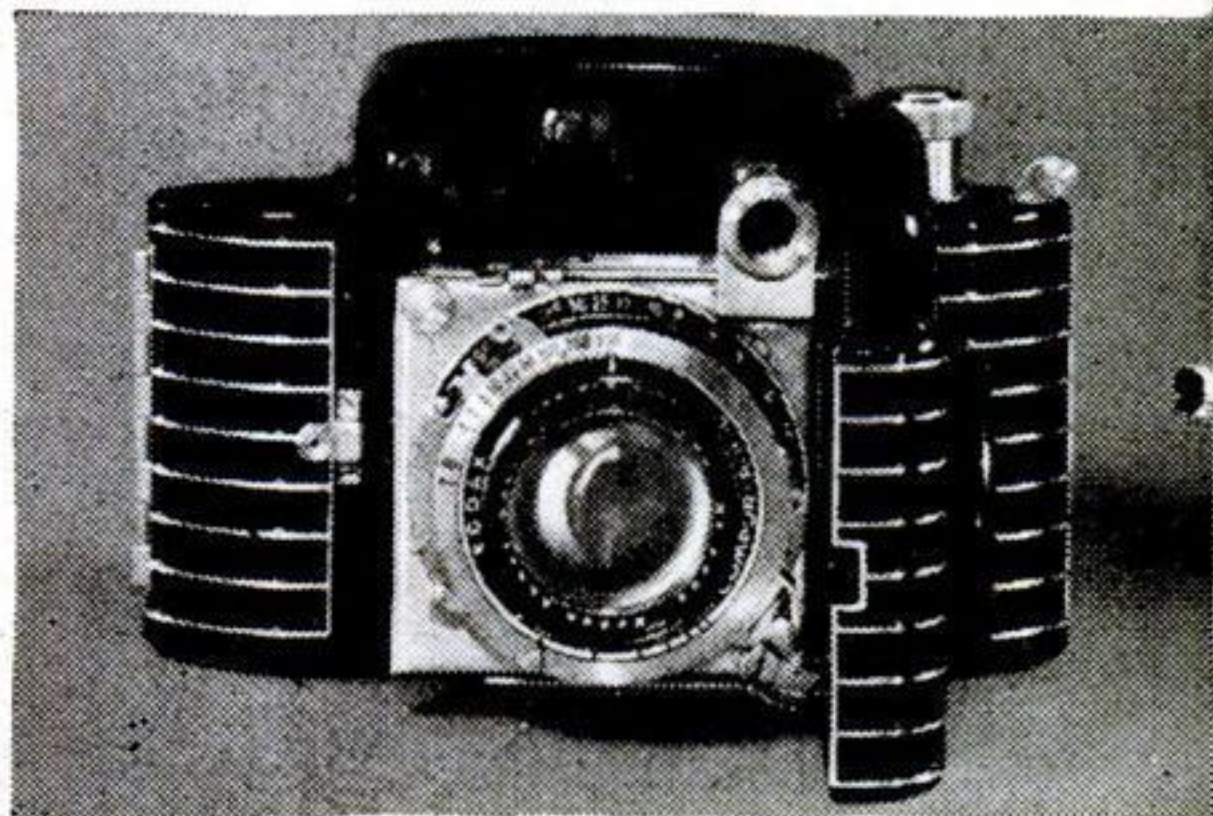
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NEW KODAK BANTAM ($f.4.5$)

(right) Kodak Anastigmat Special $f.4.5$ lens. $1/200$ -second shutter. Plunger-type body shutter release helps minimize camera movement. Folding optical eye-level finder. Automatic film-centering mechanism. \$27.50.

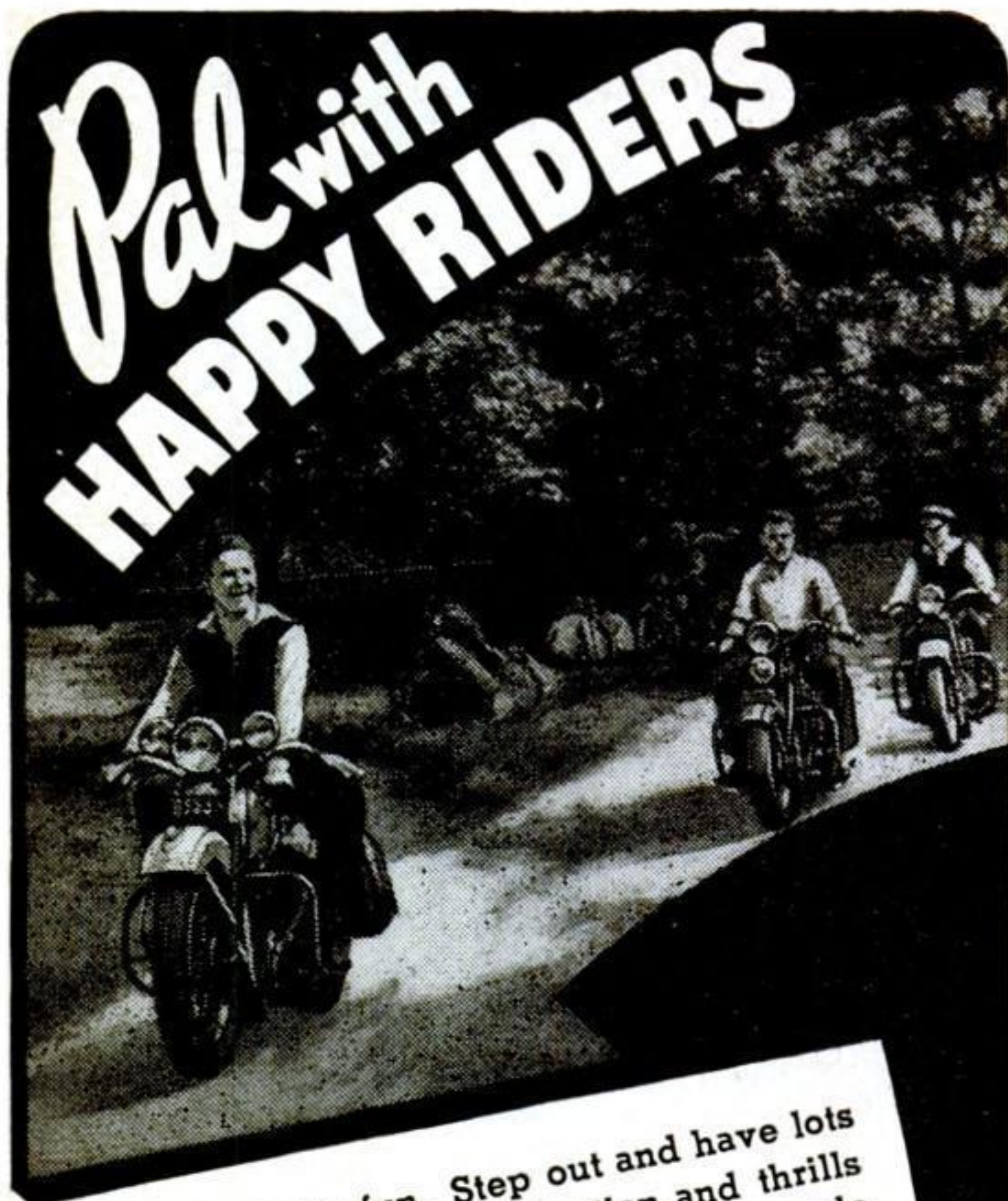
NEW KODAK BANTAM ($f.5.6$)

(not illustrated) Palm size. Kodak Anastigmat $f.5.6$ lens. Shutter has speeds of $1/25$, $1/50$, and $1/100$ second. Eye-level finder. Film-centering mechanism. \$16.50.



Lower priced Kodak Bantams, for black-and-white pictures only, include the $f.6.3$ model at \$9.50 and the $f.8$ model at \$4.75. See these and other up-to-the-minute Kodaks at your dealer's . . . Eastman Kodak Company, Rochester, N.Y.

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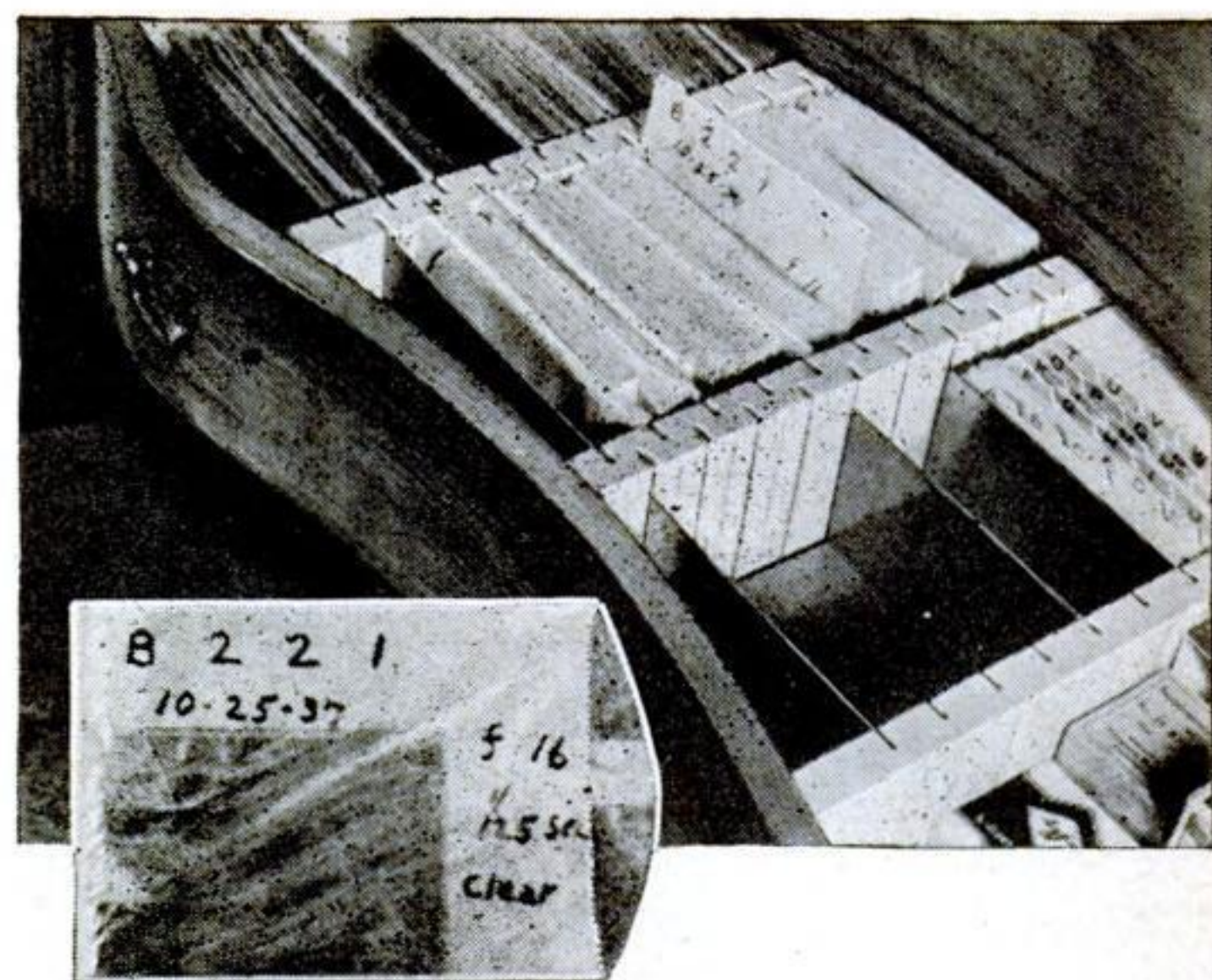
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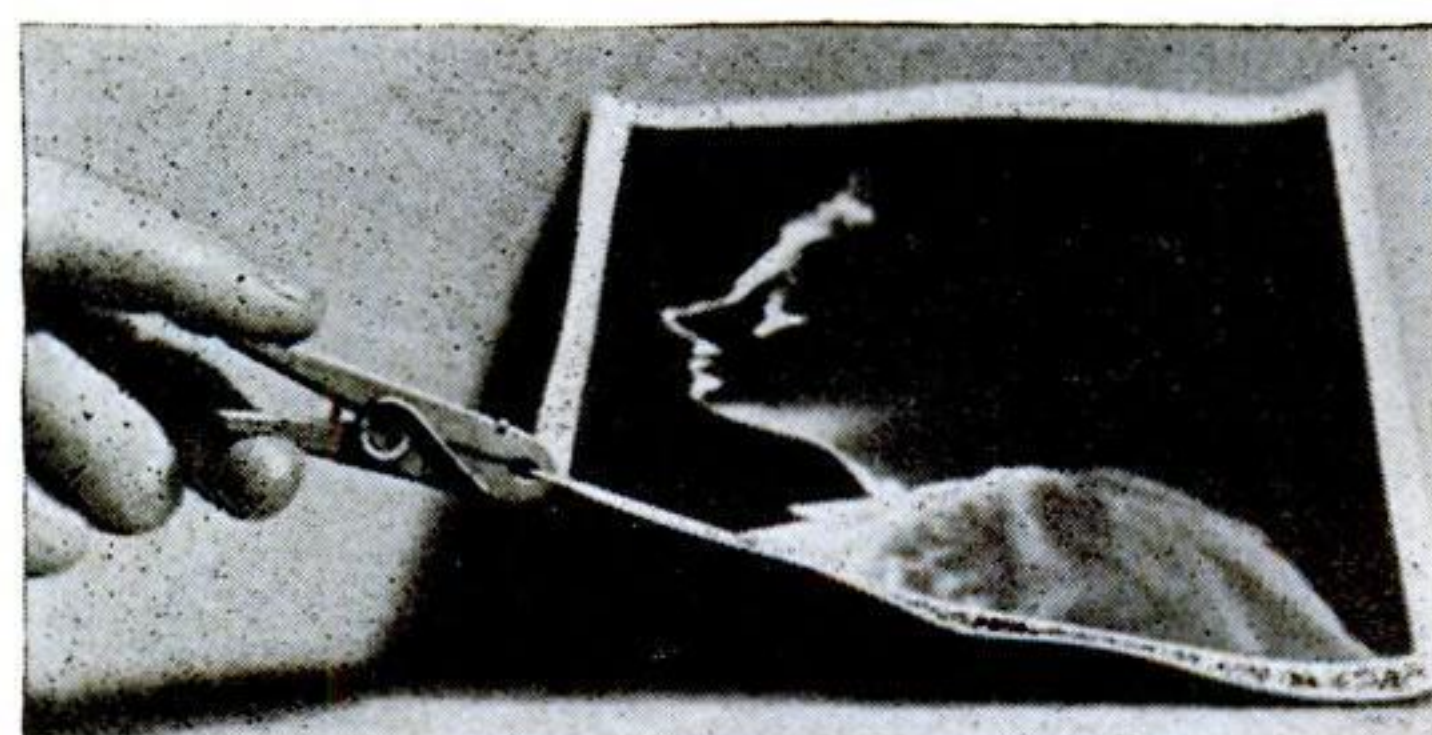
Code for Filing Negatives

AFTER trying several methods, I developed the following system for filing negatives. Each negative is placed in a transparent envelope which is marked with a code designation in addition to the date taken and any other information. A letter represents the place taken, such as A, Richmond Hill; B, Niagara Falls, etc. The first number indicates the number of persons in the picture. The second number shows whether the photo was taken 1, indoors, or 2, outdoors. The third number indicates who was included: 1, immediate family; 2, relatives; 3, friends. In marking the envelope, a negative pencil works well. A desk drawer was arranged to hold the file as illustrated above.—GEORGE R. BASTEDO.

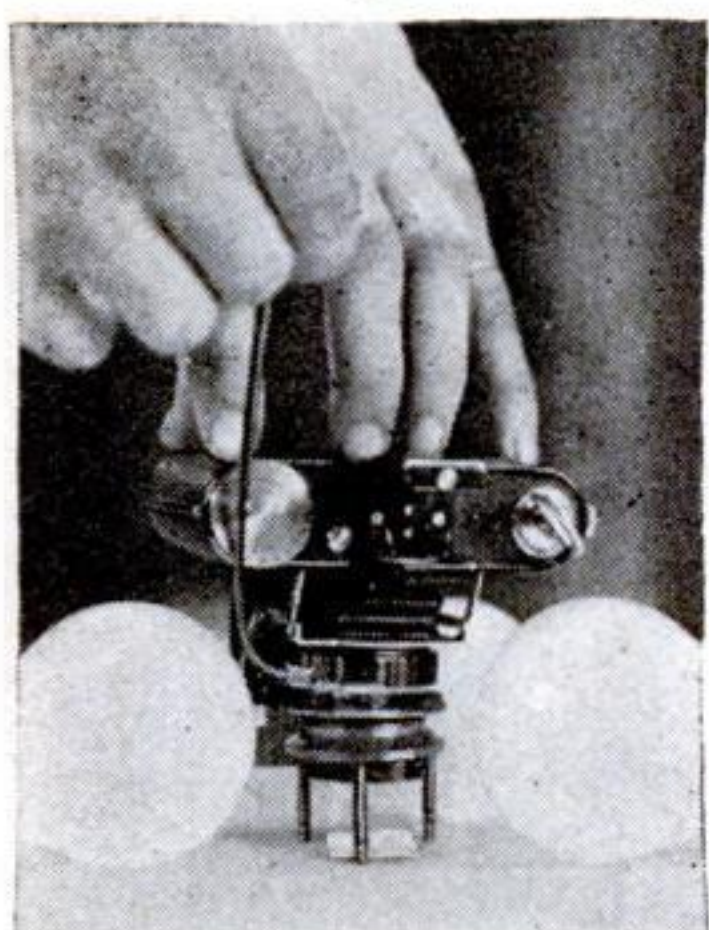


Efficient Print Tongs from Wooden Clips

BY TAPERING the ends of a wooden spring clothespin with a pocketknife, as indicated at the left, you can make print tongs that are more convenient in one respect than the ordinary type. These tongs grip the print firmly, but require pressure only when the print is scooped up or released.—LOUIS HOCHMAN.



Taking Magnified Photos



FOR photographing small objects, a tripod microscope proves useful. Place the microscope on white cardboard and rotate lens slowly until the sun or some other distant light casts a sharp image. Focus camera at 100' or infinity. Cut a washer from inner tube to go between

lens and microscope. Center object under tripod and use three 60-watt bulbs placed as close as possible. Expose $1/25$ second at $F/16$.—C. W. RICKMAN.

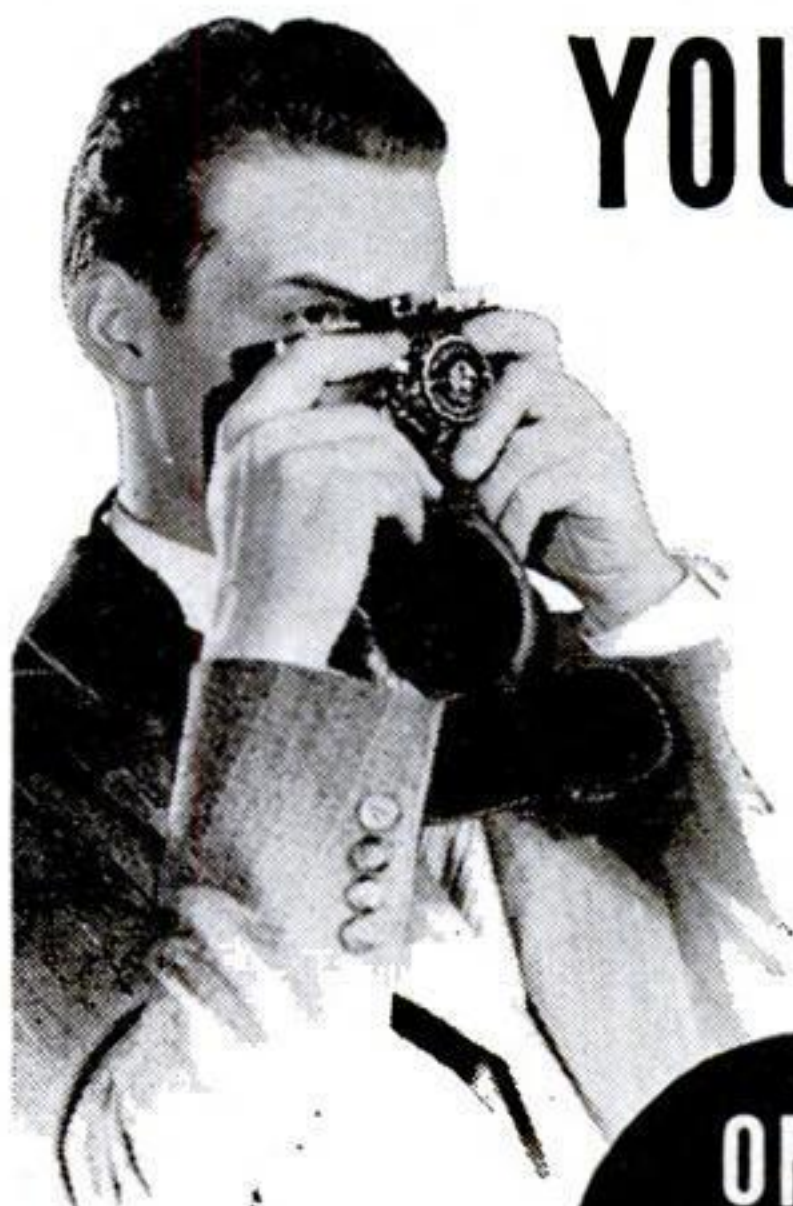
Sets for Table-Top Shots

ILLUSTRATED pages from magazines make excellent backgrounds for table-top studies. In each case mount the picture on cardboard and focus the camera sharply on the objects in the foreground. The background should be out of focus so that the halftone screen of the picture is not discernible.—E. A. BOWER.



Only two toy dogs from the ten-cent store and a magazine illustration were required for this study

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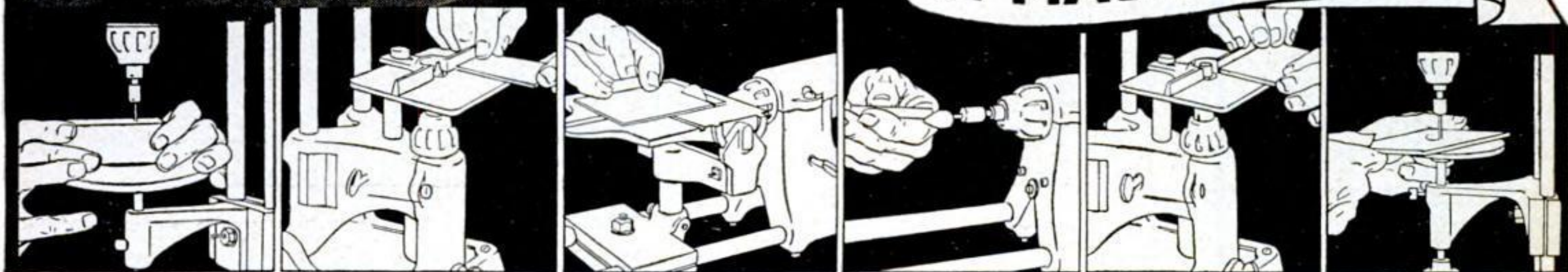
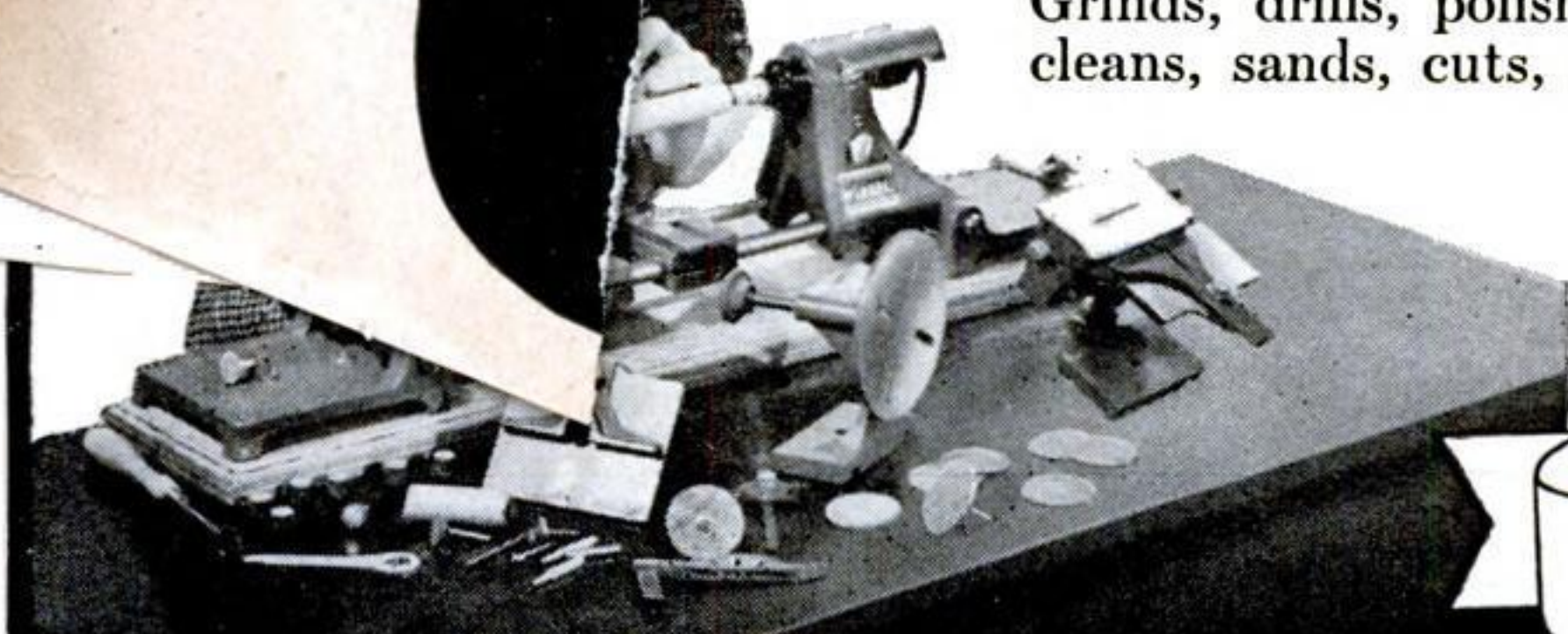
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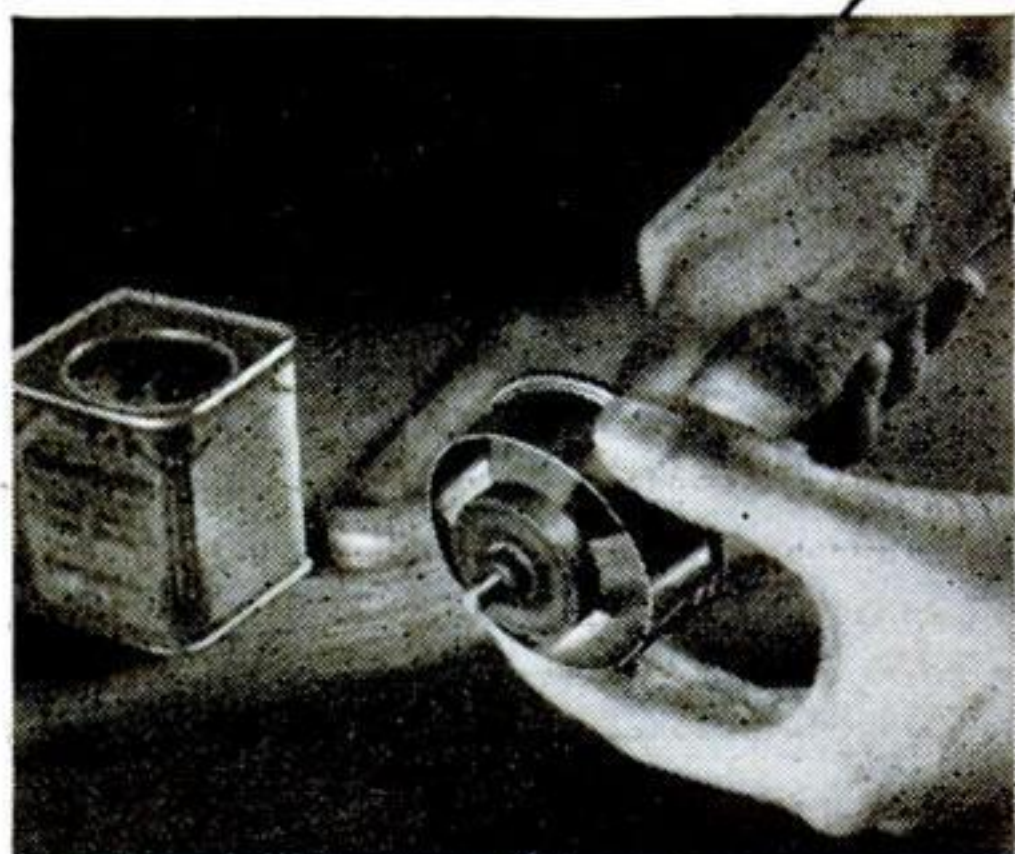
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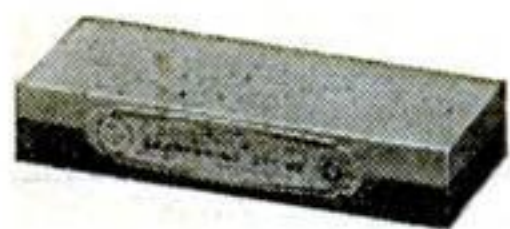
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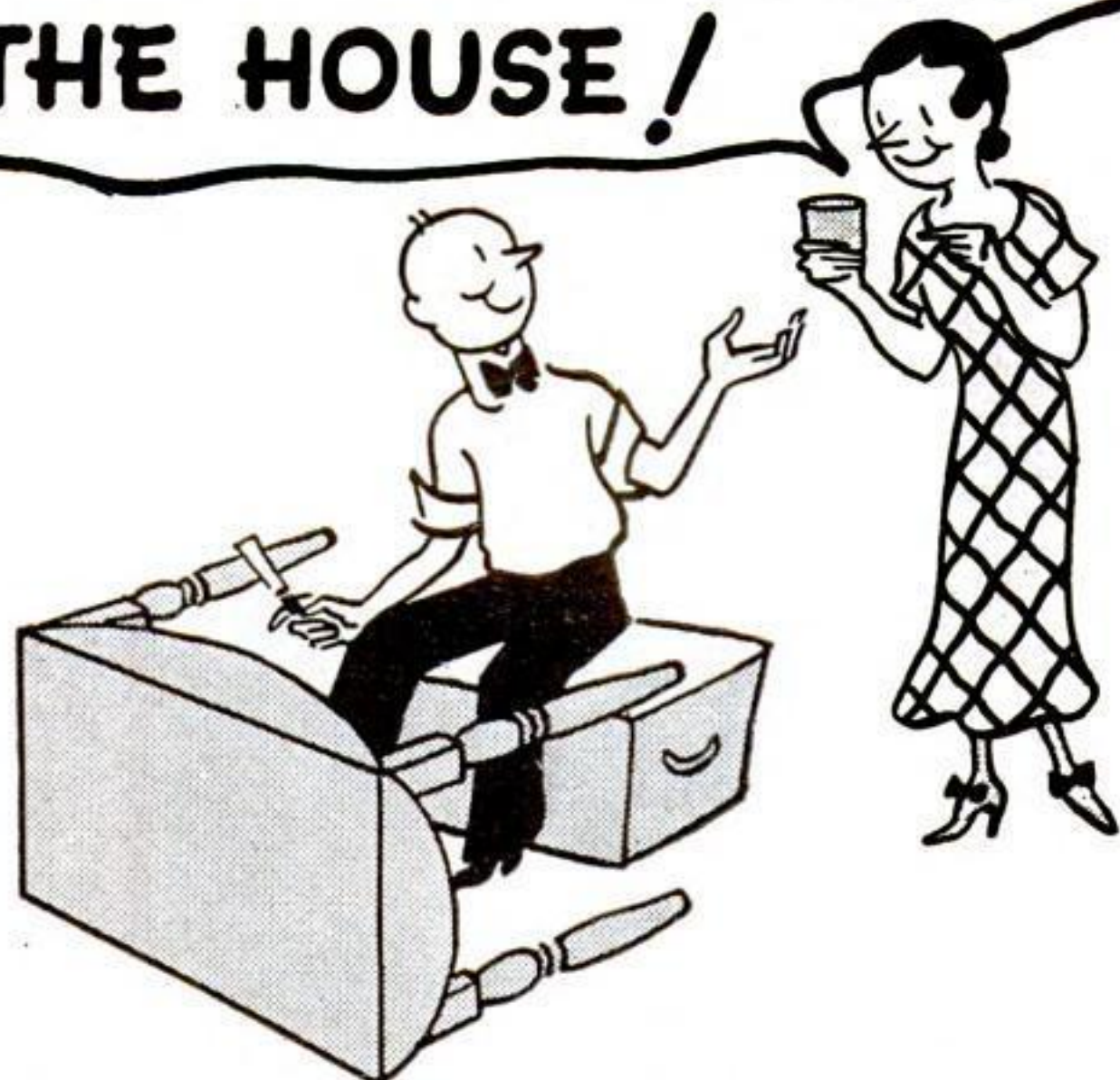
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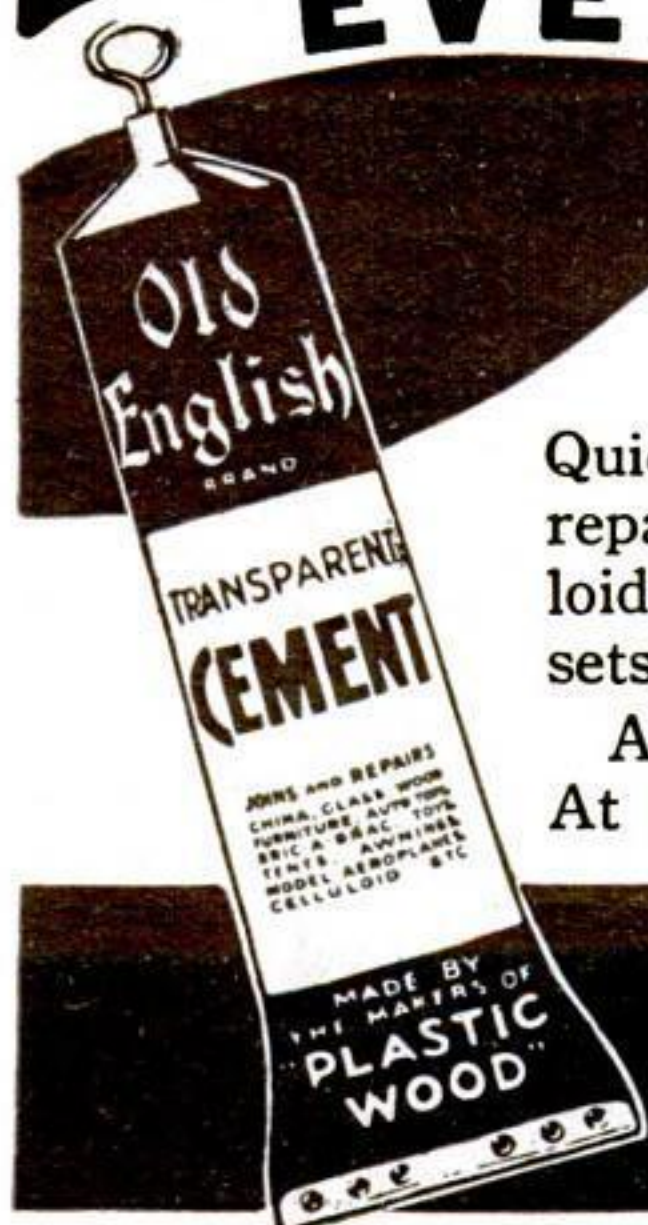
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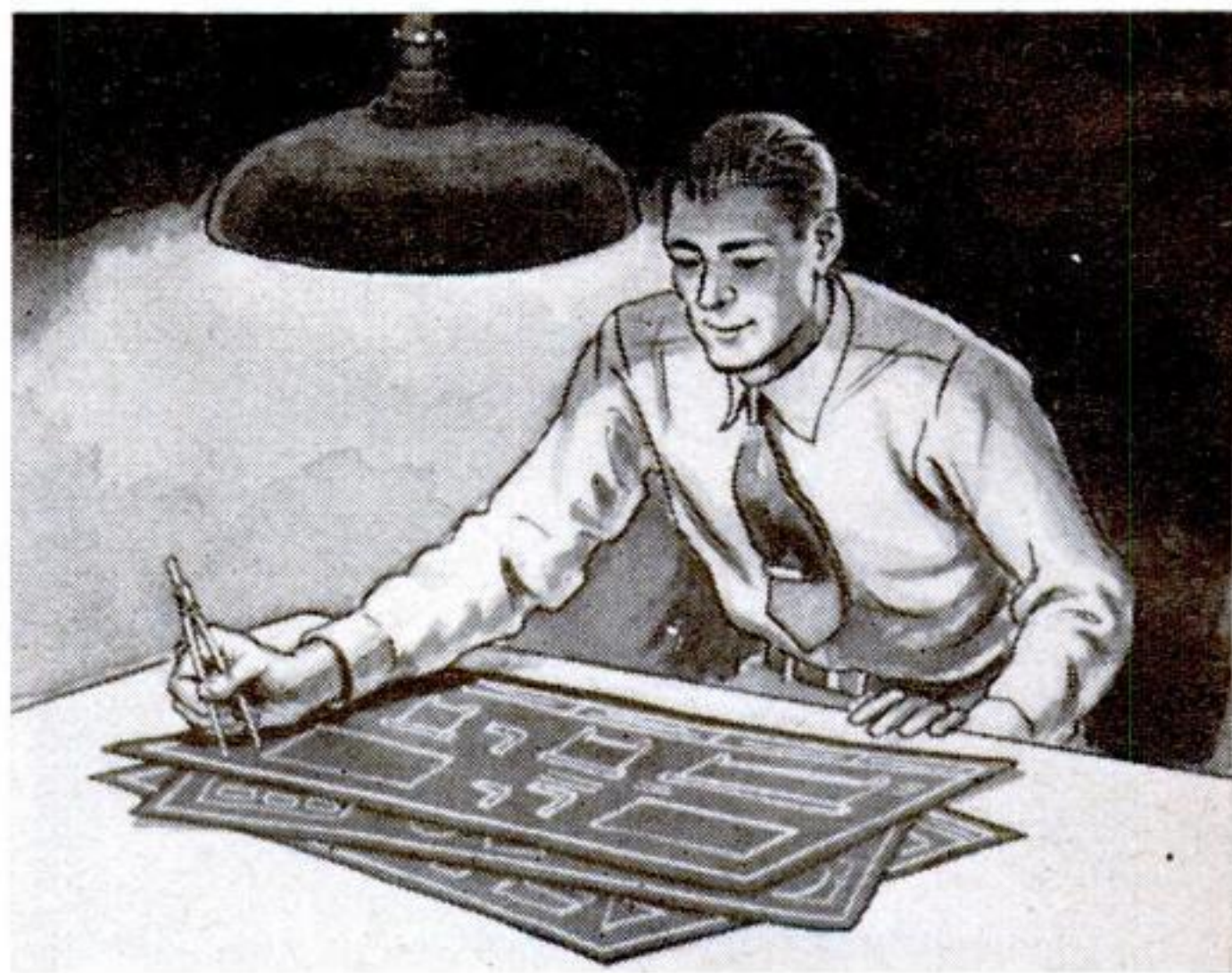
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When a considerable amount of work is to be removed by drawfiling—for example, on the edge of a metal sheet or plate—use a Nicholson or Black Diamond double cut file. However, the double cut file leaves small ridges in the work and consequently a smooth surface is required. In this case, use a Nicholson or Black Diamond Mill File.

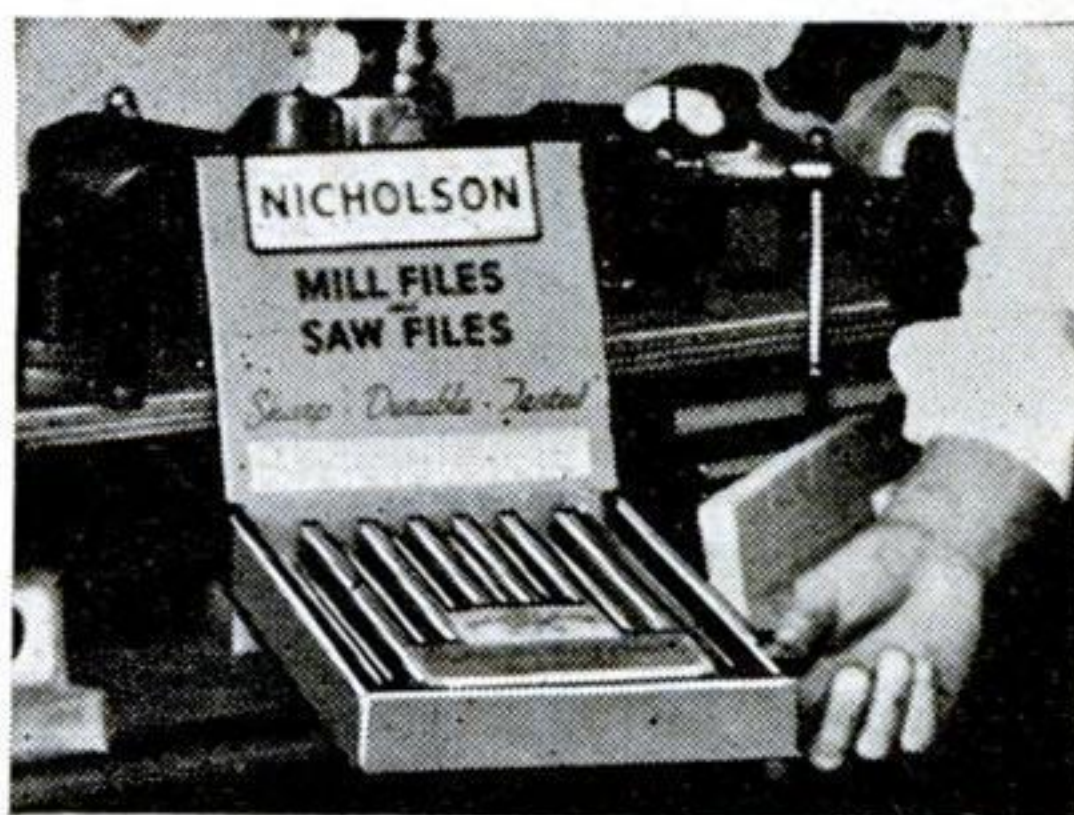
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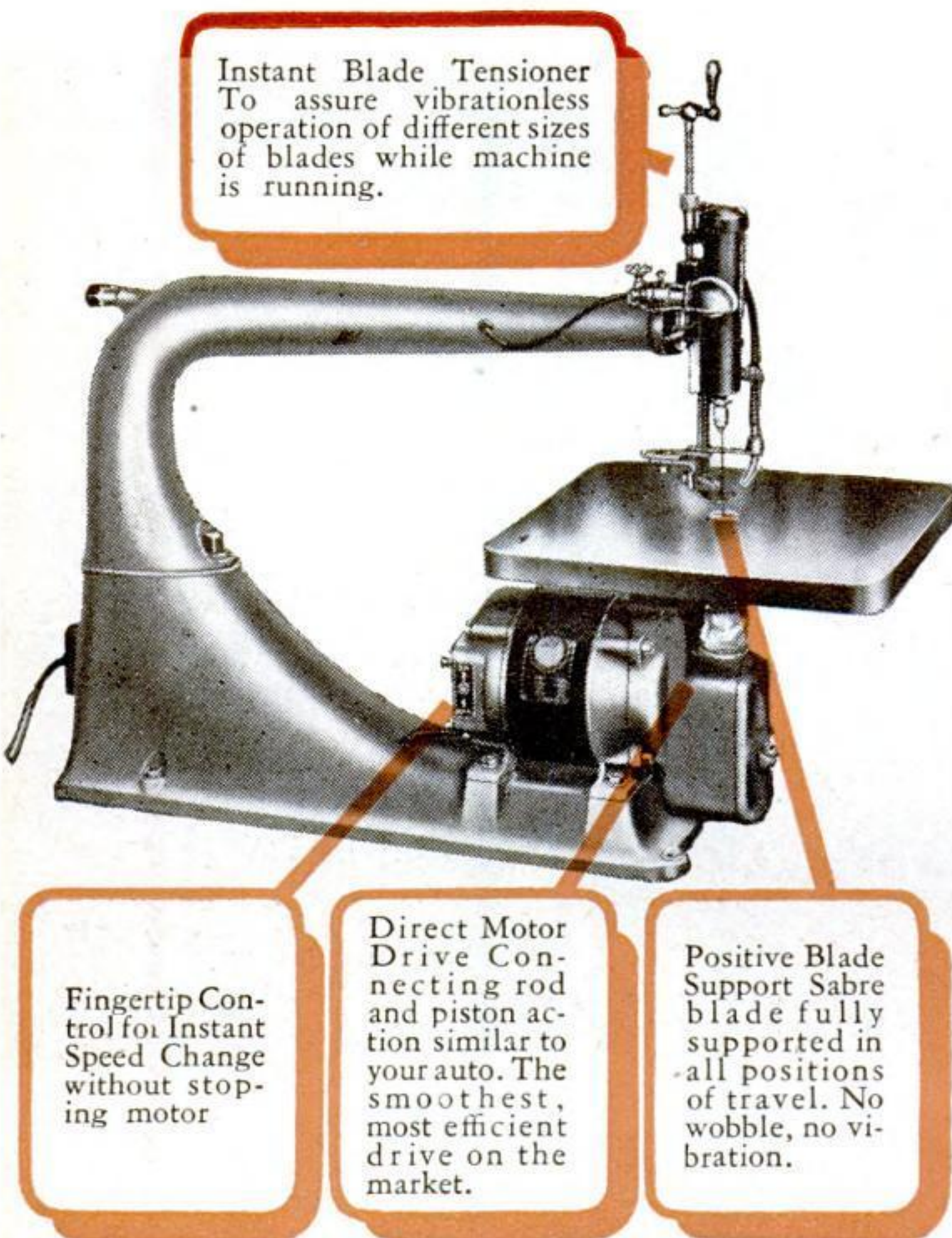


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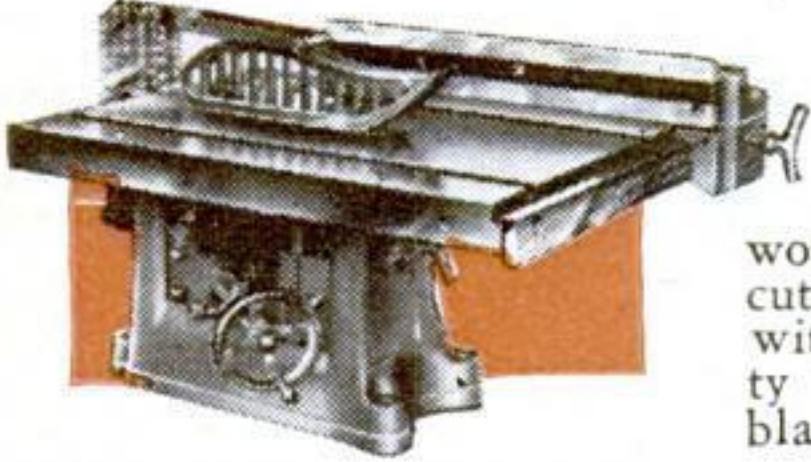
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(Continued from page 238)

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MISCELLANEOUS

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Baby's Crib and Play Pen, 26..... .25
Birds and Animals, jig-saw patterns, 56..... .25
Cigarette Holder, designed in form of miniature three-gun naval turret, 299A..... .25
Colonial Design Doll's House, 72..... .25
Doll's House Furniture, 73..... .25
Electric Teacher (question-and-answer game), 302A..... .25
Mail Box with Buzzer, Toy Target, and Modern Scroll-Type Metal Book Ends, 303A..... .25

MODELS

Aircraft Carrier *Saratoga* (18") and a Flush-Deck Destroyer (6 1/4"), 226-227-R..... .75
Barnegat Lighthouse, 10 1/2" high, 298A..... .25
Bluenose, famous fishing schooner, 17 1/2" hull, 110-111-112-R..... 1.00
Civil War Ships *Monitor*, *Merrimac*, and *Hartford*, water-line models 3 1/2", 5 3/8", and 5 1/8" long respectively, 258..... .25
Clipper Ship *Great Republic*, 31 1/2" hull, 272-273-274-R..... 1.25
Clipper Ship *Sea Witch*, 9 1/2" hull, 219..... .25
Coast Guard Patrol of 165-ft. Type, 20 5/8" hull, 286-287-R..... .75
Concord Stagecoach *Diamond Tally-Ho*, 20 1/2" long, 115-116-117-R..... 1.00
Confederate Raider *Alabama*, 21 1/2" hull, 335-336-337-R..... 1.50
Elizabethan Galleon *Revenge*, 21" hull, 206-207-208-209..... 1.00
Fishing Schooner *We're Here of Captains Courageous*, 9 1/2" over all, 351..... .25
Gettysburg Cannon, 11 5/8" long, 292A-293A..... .75
H. M. S. *Bounty*, 8 1/2" hull, 254..... .25
Liner *Normandie*, 20 5/8" hull, 264-265..... .50
Liner *Queen Mary*, 10 1/4" hull, 283..... .25
Locomotive, Hudson type, HO gauge, 14" long, driven by 6-volt motor, 329-330-R..... .75
Nourmahal, power yacht, 8 1/8" hull, 276..... .25
Ocean Freighter, 14" hull, 271..... .25
(Construction kits are available for some of these models. Turn to page 252.)

RADIO

All-Wave Portable Receiver, 2 tubes, battery operated, 217-R..... .50
Amateur Short Wave Receiver, 3 tubes, battery or 110-volt A.C. or D.C. operation, 155..... .25
Full Electric Headphone Receiver (can be made compact for portable use), 130..... .25
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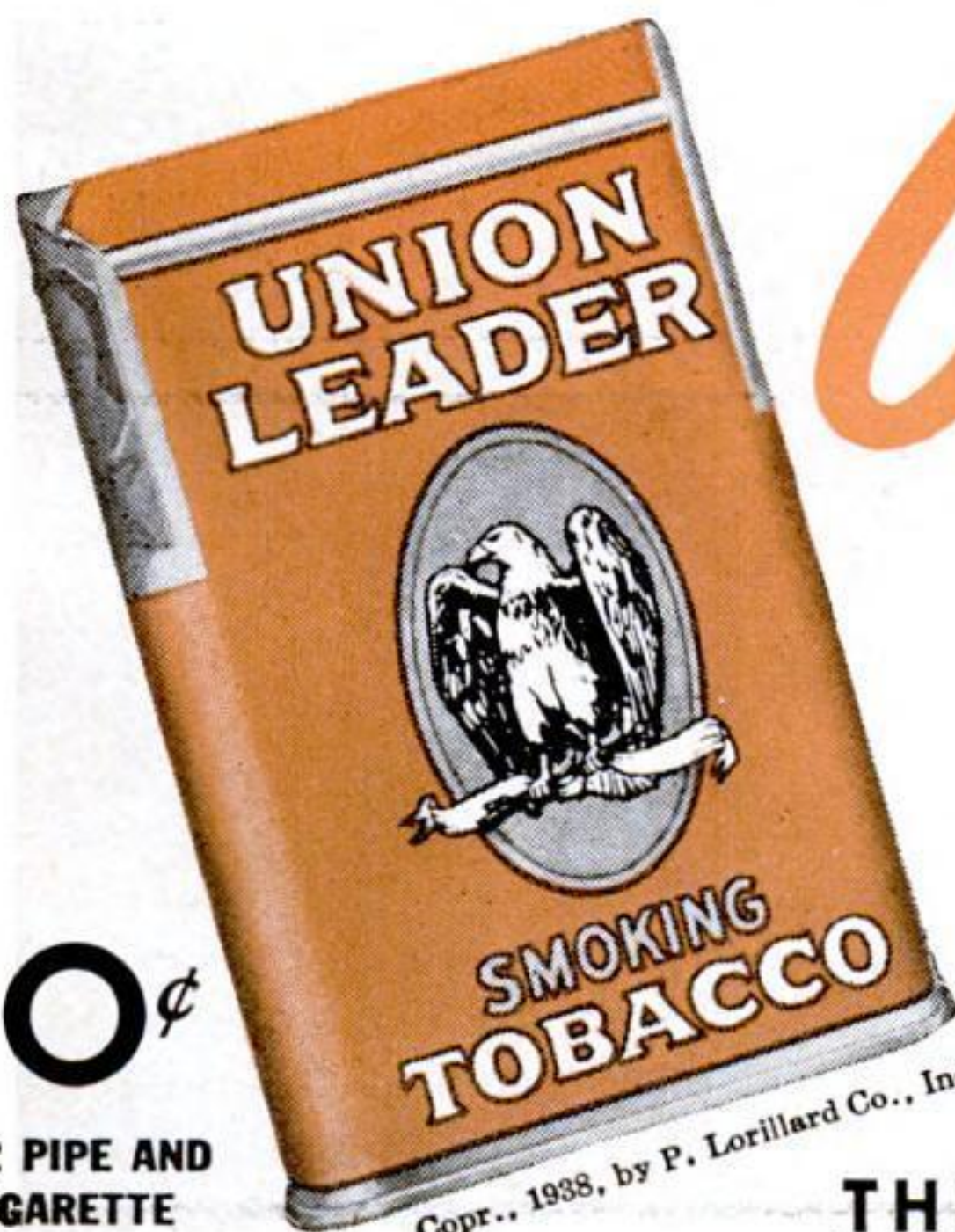
...through the years



IN 1907 . . . "Meetin' the right pipe tobacco is pretty near as difficult (and important) for a man as courtin' the right girl. I didn't get hep to Union Leader until a travelin' man loaned me some about the time this snapshot was taken. But I've had cause to thank that fellow ever since for my favorite smoke."



TODAY . . . "Here's the 'right gal, the right tobacco' and me, all photographed together. When a man, woman and tobacco get along good as us all these years they got to have something. Union Leader's got enough goodness to last a man all his life." C. S. Ross, Route 3, Farmington, Ia.



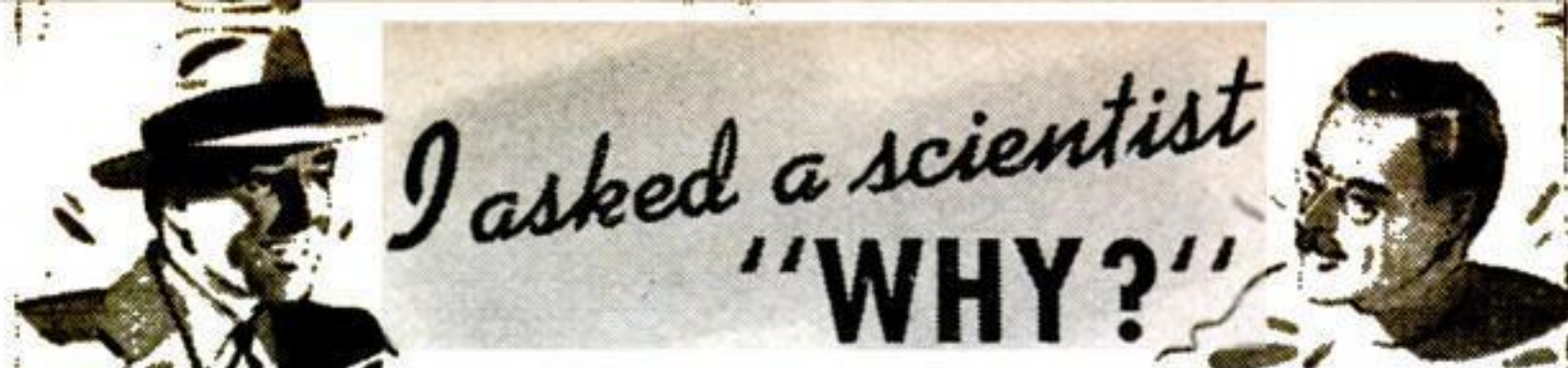
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THE GREAT AMERICAN SMOKE



I'm a traveling man and I have to keep my car in good shape. One thing I've found out is that I need a new set of spark plug wires every 10,000 miles. If I go longer than that, the car begins to lose its pep—and my gasoline bills go up. So you can bet I have a check-up made regularly.



The last time I had my car overhauled, the mechanic sold me a set of spark plug wires called Packard 440. They were different from any I'd ever seen, with a black, rubber-like protective sheath instead of the usual cotton braid and lacquer covering. He said they would last twice as long.



I'm a curious cuss, so the next time I was driving through Warren, Ohio, I stopped at the Packard Electric factory where they make this Packard 440 cable. They took me to the Research Laboratory, and I asked the first scientist I met there—"Why is Packard 440 better cable?"

AND HERE'S WHAT HE TOLD ME . . .

"Well," he said, "to answer that question we have to consider first what spark plug cables are. They are wires designed to carry the tremendous surge of electricity to the spark plugs without leakage; a thick rubber insulation is the only thing that will do this.



"But rubber is an *organic* material. It comes from trees, and, like all organic materials, it becomes cracked and rotted by heat, oil, moisture, age and abrasion. Moreover, rubber is easily oxidized by the ozone from corona which surrounds high-tension wires. Oxidation is like slow burning.



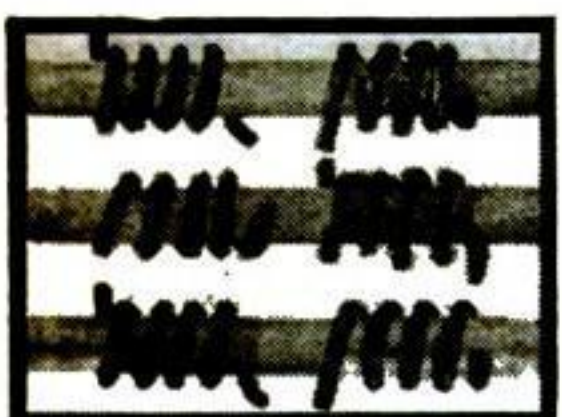
"To protect the rubber, cable manufacturers have been using cotton braid and lacquer. But these materials are *organic* too—both derived from the cotton plant! Therefore they are broken down by heat, oil, moisture, age and abrasion. Soon the rubber is exposed, to be eaten away by corona.



"So Packard set out to find some sort of protection for the rubber insulation which was *not* organic. It had to be pliable, tough, and able to stand up under the most grueling tests we could devise here in the laboratories. At last we found it—a secret-formula, *inorganic* sheath.



"This new sheath is a composition made from coal, salt and water. It looks and feels like rubber, but it resists heat, oil, moisture, abrasion, age and corona because it is *inorganic*. It's the first really satisfactory solution to the problem of protecting the rubber insulation."



Well, to prove it to me he brought out some 1-inch mandrels with six different cable samples wrapped around them. They had all been through the same series of tests—hot oven, hot oil, salt water, high voltage. The five lacquered cables were cracked and ruined. The Packard 440 was good as new!

That convinced me that he knew what he was talking about. But the *real* proof of these Packard 440 cables is the way they've stood up in my car. 20,000 miles, and no sign of cracking! Better pep, power and mileage than ever! Mister, just try 'em!

Packard Electric Division, General Motors Corporation, Warren, Ohio



Equipping Your Microscope for Polarized Light

(Continued from page 203)

you will see luminous areas and streaks appear, indicating that the celluloid has been placed under a strain. In a similar way, glass can be examined to see whether it has been annealed properly. By heating one end of a glass microscope slide until it is a dull red, and then letting it cool, you can create strain patterns that will be visible in polarized light.

Obtain a potato, cut it in two, and scrape one of the fresh surfaces with the knife blade. Transfer to a slide some of the mushy fluid thus obtained, and add a cover glass. In polarized light, the cellulose of the cells will be bright, and the starch grains will show a dark cross that rotates as the analyzer is turned. This, incidentally, is one of the standard tests for starch in analyzing botanical materials. Some vegetable fibers, such as linen and cotton, being mostly cellulose, are brilliant in polarized light. Among the animal substances that are interesting to examine are bone and hair, especially white hair.

Perhaps the most striking objects for polarized-light study are various chemical crystals, because of the vivid colors they produce. In most cases, slides of such crystals are prepared by putting a few drops of the chemical solution in their centers, and letting the water evaporate. Try mixing two or more chemicals on the same slide. Copper sulphate to which a little magnesium sulphate (Epsom salts) has been added will give beautiful results.

There are various ways of modifying the effects produced by a polarizing material such as a chemical crystal. One of these is to insert, somewhere in the beam between polarizer and analyzer, a sheet of mica. Another stunt is to employ a sheet of transparent cellulose film. Such modifiers generally can be placed most easily beneath the object, or beneath the microscope stage, although they work well immediately below the analyzer. A convenient way of mounting mica or cellulose film is to cut two identical rectangles of cardboard, 1½" by 4" being a convenient size. Drill or cut several holes ½" to 1" in diameter in the cardboards when they are superimposed. Place, over each hole, a piece of mica or cellulose film of different thickness, and fasten the two rectangles together with glue. Such a plate, when inserted in the polarized beam, will modify the colors of crystals, produce colored background effects, and otherwise alter the appearance of the object being examined. Different thicknesses will give different effects.

POPULAR SCIENCE



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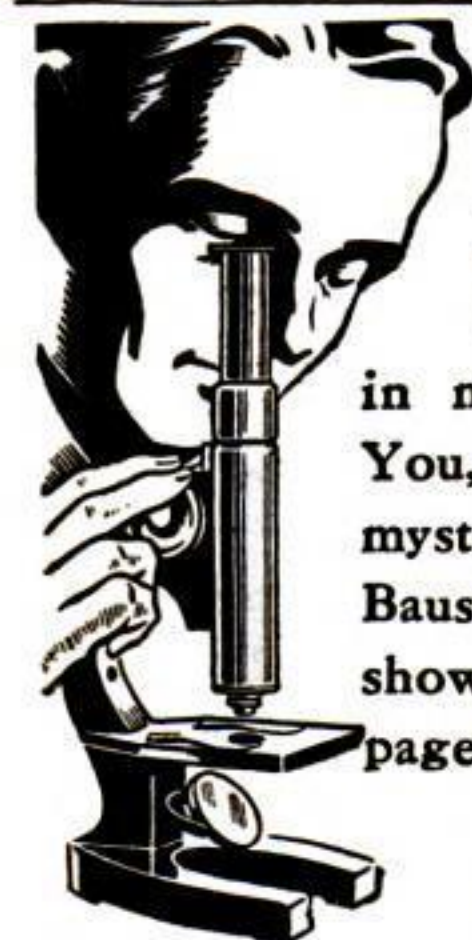
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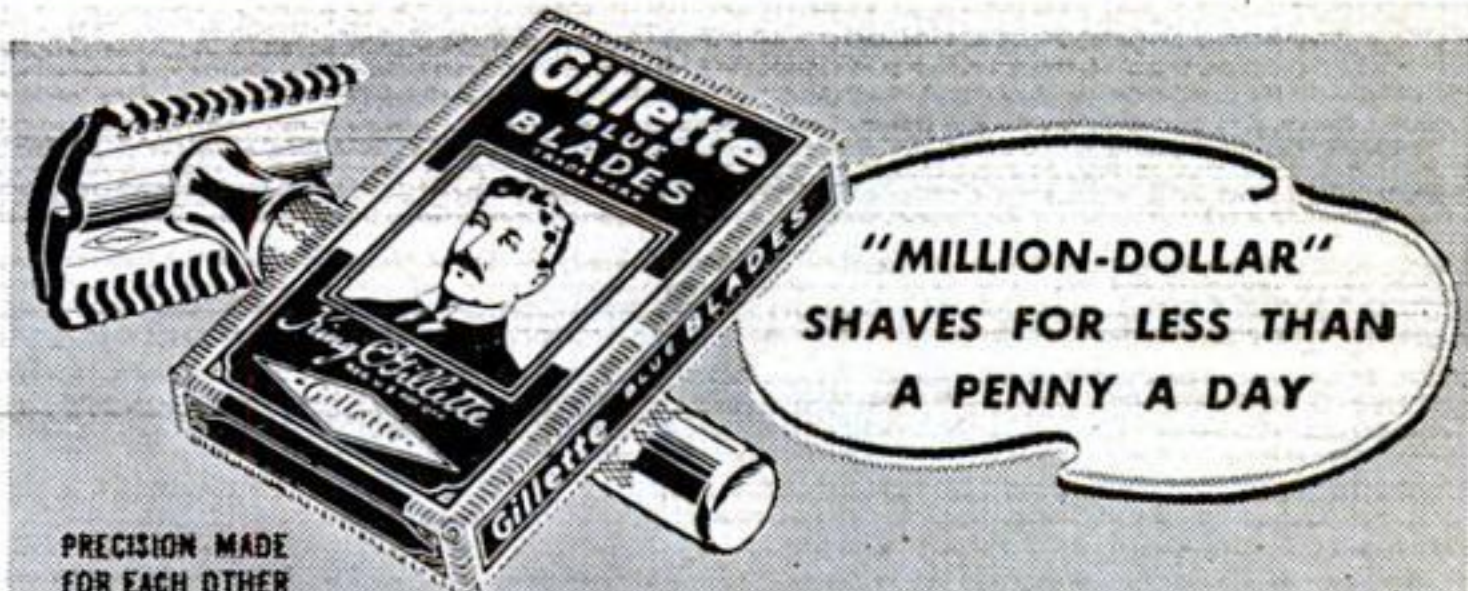
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"The Jigsawer" cuts wood 2" thick. **\$150 PRIZE CONTEST**

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How To Analyze Foods

(Continued from page 209)

appears; evidently the starch has been changed into something else. What this is can be shown by testing for sugar.

The sugar test, a familiar one to biological chemists, is made with a reagent called Fehling's solution. You can readily prepare it for yourself. Dissolve seventeen grams (three and a half teaspoonfuls) of copper sulphate in a little water, and then dilute the solution with more water to a total volume of 250 cubic centimeters, or a glassful. Make up a second solution by dissolving ninety grams of Rochelle salt (sodium potassium tartrate) in water; adding twenty-five grams (five teaspoonfuls) of sodium hydroxide; cooling the solution; and diluting with more water to a total volume of 250 cubic centimeters. To test for sugar, take five cubic centimeters of each of these two stock solutions and dilute the mixture with twenty cubic centimeters of water, which will give you a Fehling's solution of the proper strength. When this blue-colored reagent is heated with certain kinds of sugar, it turns yellow or brown, owing to the formation of cuprous oxide. Ordinary sucrose or cane sugar (table sugar) does not produce this color change, but it does occur with the synthetic sugar that you have prepared from the corn starch.

Would you believe that a chemist could turn paper into sugar? You can actually perform this feat of chemical wizardry yourself—and prove that you have done so with the aid of your Fehling's solution.

Grind about four square inches of filter paper in a mortar with strong sulphuric acid. Take care to keep the powerful acid from spattering upon your skin or clothing; a simple and effective precaution is to cover the mortar with a piece of cloth, with a hole cut in its center for the pestle. Use enough acid so that all the paper will be dissolved, which will require about ten cubic centimeters. Pour the solution, a little at a time, into about fifteen cubic centimeters of water in a flask. Immerse the flask in boiling water and heat it for half an hour. At the end of this time, remove about five cubic centimeters of the liquid, add sodium carbonate solution until it is alkaline, and test some of it for sugar by heating it with the mixed Fehling's solution. The blue reagent will become discolored, showing that sugar has been formed from the paper. The role of the acid in this reaction is a mysterious one; apparently it plays the part of a catalyst, remaining unchanged but enabling the cellulose, or paper, to combine with a molecule of water and in doing this become a sugar.

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King of the Stunt Flyers

(Continued from page 101)

for the coveted trophy, which Rankin won.

If you pin him down to a discussion of the most difficult precision maneuver, Rankin probably will talk about a slow roll. This isn't particularly exciting to watch. It looks very simple, yet it requires coördinated use of all three controls with split-second precision while the wings revolve around the body of the plane during straight-ahead flight.

Rankin executes what he calls a "slow slow roll" in twenty seconds. He times himself, and permits a deviation of no more than one second. He starts an ordinary slow roll at 150 miles an hour and comes out at 110. But for a slow roll at low altitude, under 500 feet, he whips his plane up to 180. Sometimes he does a slow roll no farther up than 100 feet, but these are hazardous, and he tries them only when he has enough speed to zoom up and right his plane in case anything happens.

One of Rankin's most difficult feats is the speed dash performed upside down near the ground. He dives his ship wide open from 1,500 feet, turning over in the dive and leveling off a scant 100 feet from the runway. While screaming across the field 300 miles an hour, he lets the ship down another seventy-five feet. Twenty-five feet between his helmet and hard earth! Then he zooms upward to complete one half of an outside loop.

But there's a secret to this kind of flying: three of them, in fact. First, Rankin makes sure he has enough speed to climb in case his engine quits. Second, instead of trying to watch the earth, he judges his height by watching distant buildings, trees, or a fence. Third, he performs his maneuver hundreds of times at a safe elevation before attempting it near the ground.

"You should explain," he insisted while discussing this hair-raising evolution, "that I have been practicing this stuff for almost twenty years. No pilot should attempt it without years of practice."

In the one-and-a-half snap roll, he flies his ship on its side at high speed, then snaps it over in a roll and catches it on the other side. In order to fly the ship on its side and not lose altitude, it is necessary to maintain an exceedingly high speed. When the control stick is pulled back violently, dangerous stresses are thrown against the wings by the centrifugal force. Last summer Rankin almost lost his engine while performing this stunt.

Only stunts to the public, these precision maneuvers mean much more to Rankin. He thinks every commercial flyer should receive training in aërobatics. "Make him a safer pilot," he declares.

Silence!

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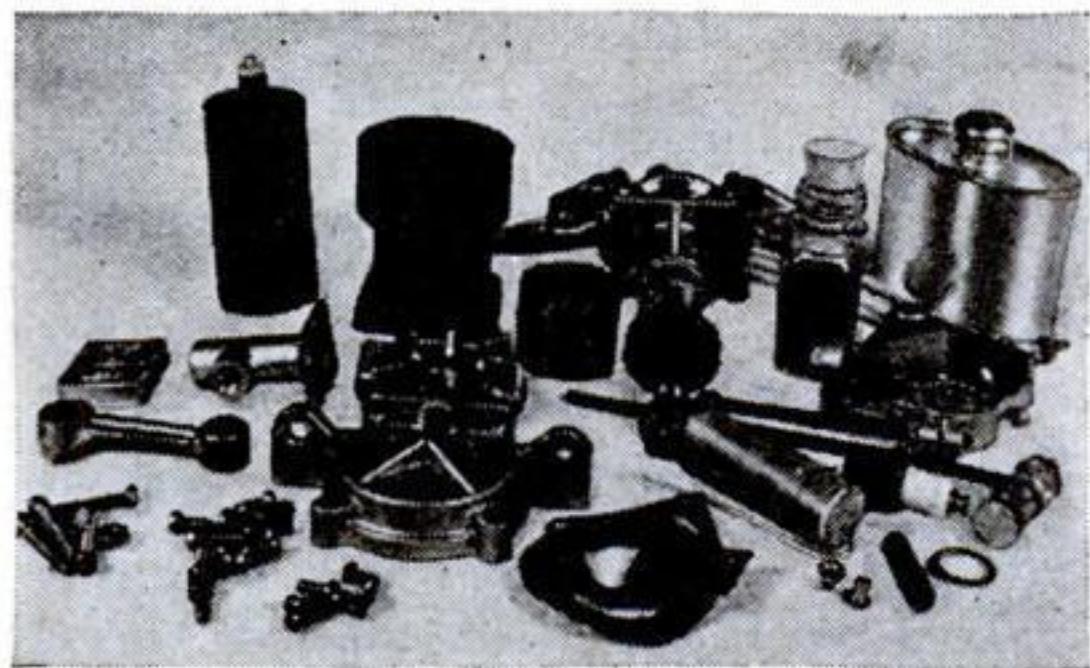
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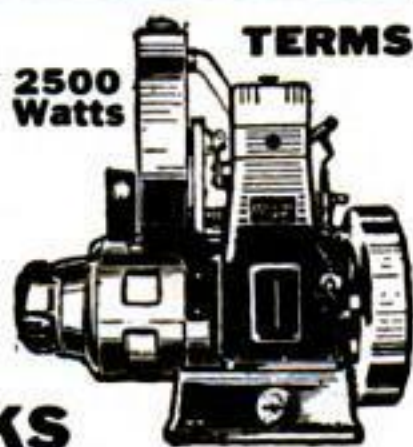
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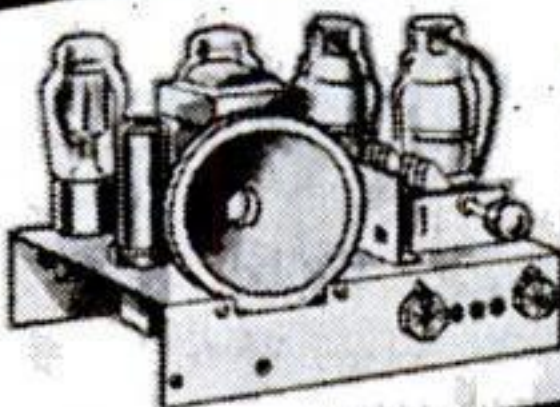
NEW SETS!

See radio's greatest values!—powerful new 1939 Knight Radios, at amazing low prices! 62 models, advanced new features. Push-Button Tuning—4-16 tubes, for AC, AC-DC, 32 Volt, battery and auto operation—new "Tiny Knights," low-drain battery sets (1.4 volt tubes), Phono-radios, record players, phonographs, etc. Send coupon today!



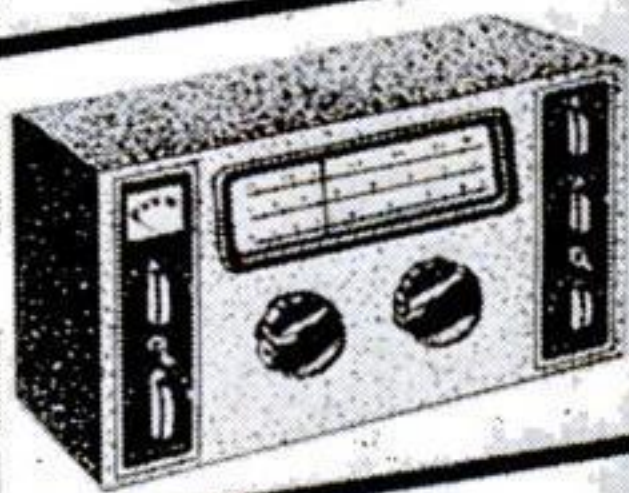
NEW KITS—PARTS!

ALLIED'S catalog shows more than 14,000 exact duplicate and replacement parts for building or repairing any circuit! And—Radio's biggest selection of Build-Your-Own kits: Beginners' 1, 2, 3 tubers; 6 tube auto set; Photo Cell; Electric Fence; 4 Tube Portable; low-cost transmitters, etc.—and 100 diagrams and projects!



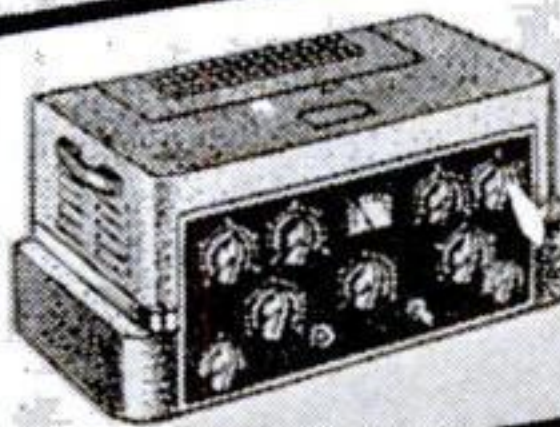
NEW HAM GEAR!

Giant new Ham section, an Amateur Catalog in itself! New Hallicrafters ship-to-shore, National, Hammarlund, Utah, and GTC Xmitters at prices to fit any purse; new receivers: National NC-510 and NC-44; Hallicrafters "Dual Diversity" and "Marine"; Sargent "Streamliner"; Howard, many others, all at lowest prices!



NEW SOUND SYSTEMS!

See a complete range of revolutionary new P.A.—8 to 65 watts—remarkable values! New Portable systems, 30-watt Mobile System, Booster-Power Stage, Electric Guitar Amplifier. New Record Changers, Players—most complete line of recording equipment, discs, etc. in any Radio Catalog! Write for ALLIED'S free catalog today!



Testers, Books, Tools!

Complete Stocks!
Lowest Prices!

FREE! BUILDERS' PARTS LISTS

Write for Free Parts Lists showing equipment needed for building any kit described in this or any other magazine.

Free! SEND COUPON

ALLIED RADIO CORP.
Dept. 7-K-9
833 W. Jackson Blvd.
Chicago, Ill.

☐ Send me your new FREE 1939 Catalog.

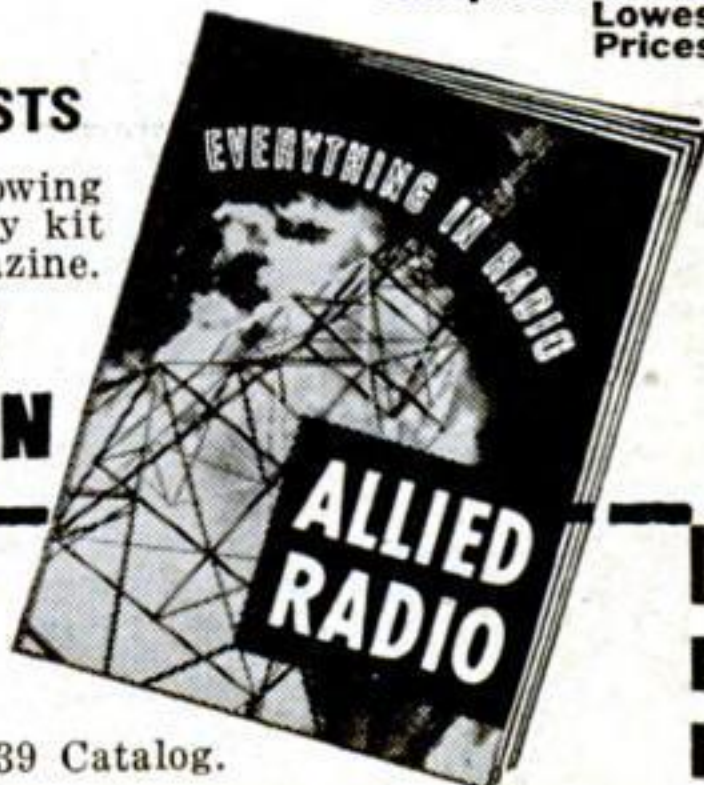
☐ Send me Parts List for.....

Name

Address

City.....

State.....



DISSTON

FINEST



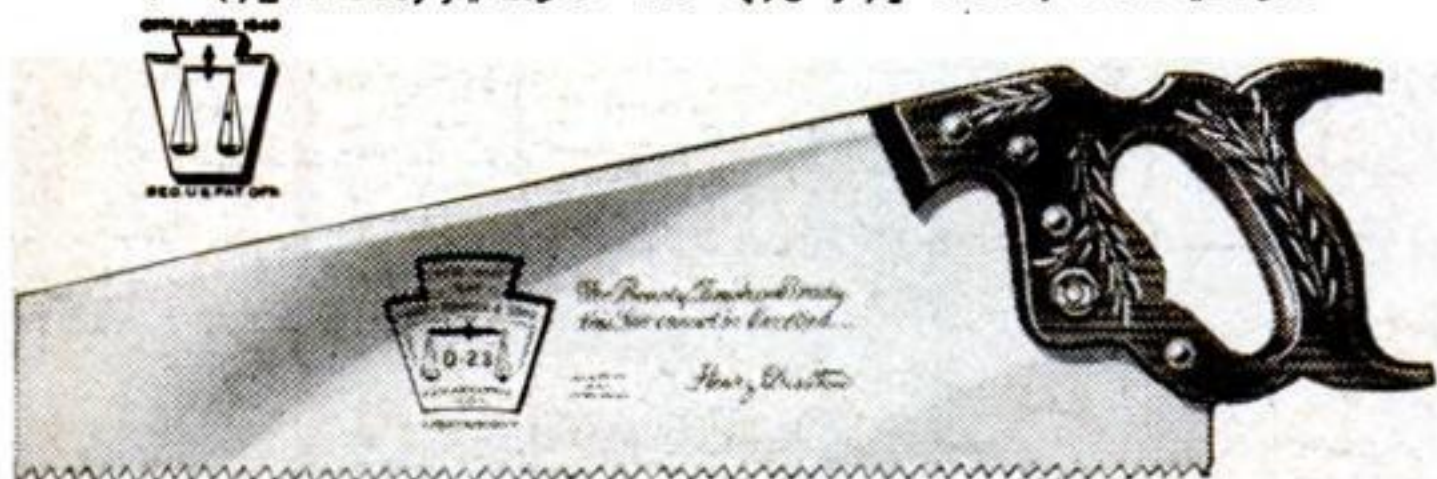
● Times change! Homecraftsmen, like mechanics, are buying the best saws made. The thriftiest home workshop circular saw is Disston DeLuxe. On any job, it means easier, more accurate cutting. It gives a lifetime's satisfaction.

DeLuxe Cross-Cut—Rip—Combination

6" (1/2" hole), \$2.70 8" (1/2", 5/8", 3/4" hole), \$3.50
7" (1/2" hole), \$3.10 10" (5/8", 3/4" hole) . . . \$4.50

DeLuxe Hollow Ground Combination

6" (1/2" hole), \$4.30 8" (1/2", 5/8", 3/4" hole), \$5.40
7" (1/2" hole), \$4.90 10" (5/8", 3/4" hole) . . . \$6.90



Above. D-23 Disston. One of the finest hand saws. Lightweight, straight back, narrow blade. Easy running, fast-cutting. Beautiful finish. 26" length . . . \$3.85

Also. D-8 Disston. Famous, world around, as the "Saw Most Carpenters Use." Wide blade. Skew back. Same in narrow blade for home workshop. 26" length . . . \$3.50

ASK DEALER for DISSTON SAWS

— — — — FREE MANUAL — — — —



Write us for "Saw, Tool and File Manual" telling How to Choose and Use Saws. FREE.

Henry Disston & Sons, Inc.,
1010 Tacony, Philadelphia, U.S.A.

Name _____

Address _____

Shoes from Butterfly Wings

(Continued from page 72)

His assistants are expert at the work of removing the wings, gluing them to sheets of flexible backing material, trimming around the edges, and finally decorating the backing material with coats of mother-of-pearl paint. Many of the ornaments take the form of the original butterfly. Even artificial antennae are glued in place to increase their realism.

The vital step, which Deubel always does himself, is covering the delicate wings with the protecting fluid. They are placed, a score at a time, on an adhesive sheet lining the bottom of a wooden tray, and the fluid is applied with a spray gun. It quickly hardens and the wings are removed from the adhesive and sent on down the production line where they are transformed into ornaments.

Probably the products which have attracted most attention are the "butterfly heels", which Deubel makes for dancing slippers. Hundreds of them, massed together like a rainbow garden, filled one huge table. All are produced the same way. Before the wings are applied to the wooden heel form, they are placed for half an hour in a relaxing bath formed of a special mixture of chemicals. When they emerge, they have lost all their brittleness and can be bent easily around the curved surface of the heel form. Deubel then "shingles" the form with the wings, carefully gluing each one in place. The final step is to spray a protective layer of the secret fluid over the wings.

Some of the ballroom slippers, which he has prepared for a leading shoe manufacturer, have had the straps as well as the heels covered with butterfly wings. Light, playing on these slippers during the dance, produces an exquisite, iridescent sheen.

Curiously, the most brilliantly colored butterflies which Deubel uses have no traces of pigment in their wings. The shimmering hues which reach the eye are produced by tens of thousands of minute, parallel grooves which cover the surface of the scales that coat the wings. When the light strikes the grooves, they reflect to the human eye only a few colors of the spectrum. The iridescent blue butterflies from Brazil, among the most beautiful in the world, are of this type.

Now Deubel is spending his spare time working toward another goal—the production of butterfly leather. Already, he has succeeded in making experimental samples in which the brilliant patterns of butterfly wings are woven together to form the outer layers of leather. Some day, Deubel believes, shoes of butterfly leather will be as familiar as snakeskin shoes are now.

REGROOVE NEW TREAD

on Your
OLD TIRES

\$3.75 RETAILS **Works Off**
Complete **OUTFIT** **AUTO BATTERY**
OR LIGHT SOCKET

A NEW invention makes it possible for anyone, without previous experience, to regroove the exact tread on old tires. Puts new tread on bald tires. This *Re-Nu Tire Groover* is a fine, precision built, sturdy device that does a **FIRST CLASS JOB QUICKLY and EASILY.**

Stop Dangerous Skidding!

Countless lives are lost annually due to skidding caused by smooth tires. Protect yourself by regrooving your old tires. Don't throw away good casings just because the tread is worn. Have road-gripping tread to give traction where needed. Positively guaranteed to satisfy or money refunded. **MAKE BIG MONEY** for yourself **REGROOVING** tires for your friends and neighbors.

FREE OFFER to AGENTS—Every garage, service station, fleet and car owner a prospect for a *Re-Nu Tire Groover*. By helping us introduce it, you get yours **FREE** and make big profits for yourself besides. Write for Free particulars today. **RE-NU TIRE GROOVER CO. 2615-AC Michigan Av. Chicago, Ill.**



PRACTICAL MAGNIFIERS

FOR EVERY PURSE AND PURPOSE

Sizes 1½" dia. to 5" dia. lens. Prices, 50c to \$10. Send for **FREE** Catalog of these attractive, well-built instruments.

Dealers' Inquiries Invited

THE MAG-NI-LINE PRODUCTS
3456 E. Jefferson Detroit, Mich.

FREE Sensational OFFER 2 FENCING SWORDS FREE FENCING WORLD'S FINEST SPORT HARMLESS-EXCITING FUN

Develops strong body and alert mind. **HARMLESS.** The spring-steel 3-foot-long foils (swords) are equipped with rubber buttons. Aluminum cup-shaped hand guards. Our De Luxe foils are built for hard usage.

Complete set of two foils (swords) and free instruction booklet, only \$1.98. We pay postage. Two additional fencing swords **FREE** for limited time. (Regular price of these two sets of foils \$3.96.) **ORDER NOW.** All-American Fencers Guild, Dept. 10 SP, 48 W. 48th St., New York

Let's go

Why stay at home when you can travel 120 miles on a gallon of gasoline—can get out in the sunshine and refreshing air. Cheaper than walking, than street cars or busses. Thrilling, exhilarating, healthful and smart. Until you've tried this latest development in personal transportation, you just don't know what real fun is. Light, fast, carefree—no parking worries, no garage expense. Write for catalog showing Solos, Duos (with passenger side car) and Delivery models.

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RUSH COUPON FOR OUR 576 PAGE CATALOG OF 6000 NOVELTIES!!

BROADCAST thru your radio TALK - SING - PLAY



BROADCAST your voice on programs coming through your own radio set—make announcements from any part of the house—inject wise cracks, Josh and mystify friends. Imitate radio stars, practice crooning, singing, radio acting, etc. Do a **Bing Crosby, Charlie McCarthy, Jack Benny, Benny Goodman, etc.**

World Mike

Made especially for home use, attached in a jiffy without tools. Not a toy. Put on your own programs at home, parties, club affairs, etc. Barrels of fun! Easy to operate.

Price Only 25c



DELUXE MIKE

Large, substantial, all-metal mike. Practise radio singing, broadcasting, programs, etc., thru your own radio. Reproduces voice in loud, clear tone without distortion. Regular table model—can be held in hand. Guaranteed.

Price Postpaid \$1.00

MIDGET POCKET RADIO \$1.00

Listen to Music and Sports Everywhere You Go

This amazing midget pocket radio brings in programs within 25 miles of broadcasting station—even more under favorable conditions—in the country, in bed, at camp, office, etc., etc. **ANYWHERE and EVERYWHERE** Merely connect an aerial and ground wire, attach single or double head phone and tune in. No expense to operate. No static or noise. No batteries, no tubes, no crystal to adjust. Just one moving dial to locate stations.

MIDGET POCKET RADIO. Price..... \$1.00

1-Tube Pocket Radio

Built-in phone. **MUSIC DIRECT FROM RADIO.** Beautiful Cathedral tone. Complete in one unit with batteries, tube, switch. Fits in pocket. Listen anywhere with good aerial and ground. Uses ordinary dry cells.

Price Postpaid \$3.49

MIDGET RACER

Complete blueprints for 3 different racers. The one illustrated can be built for a few dollars. All about racer parts, gears, transmissions, dirt track racers, track regulations, blueprints, plans. **ADD A MOTOR TO YOUR BIKE** at low cost. Increasing speed, etc., etc. Crammed full of information.

Over 75 Illustrations, plans & blueprints.

Live Chameleon

Watch It Change Color! A LIVE PET

Get one of these most wonderful of all creatures. Watch it change color. Study its habits. Wear one in the lapel of your coat as a curiosity. Shoots out its tongue to catch flies and insects for food. No trouble to keep. Can go for months without food. About 4 in. long. Shipped to any address in U.S.A. by live delivery guaranteed. **Price..... 25c** Add 20c for lapel coat chain. **Special Chameleon Food, 15c Package**

THROW YOUR VOICE



Into a trunk, under the bed or anywhere. Lots of fun fooling teacher, policeman or friends.

THE VENTRILO A little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it. Never fails. A complete book with full course on Ventriloquism together with the **10c** Ventrilo Sent Postpaid for only.....

Climbing Glove Monkey Dummy

Slips over hand like a glove, so you manipulate head and hands with your fingers. It climbs, nods, bows, even "talks" when you know ventriloquism! Absurdly quaint and funny. Provokes side-splitting merriment. **Price..... 15c** Deluxe Mohair Model 50c



PEA-MATIC REPEATER-12 SHOTS



25 Cents

Automatic Pea Shooting Gun

Get One Now for Hallowe'en

Shoots 12 to 15 ordinary peas without reloading. Just load the gun with peas, pull the trigger and keep on firing until the barrel is empty. Then reload and fire again. It is absolutely harmless and safe. Nothing to explode. These pistols sell like hot cakes, so get yours **AT ONCE.** Be the first boy in your town to own one.

Shoots 12 to 15 Shots Rapid Fire

Remember, unlike most guns, it costs practically nothing for ammunition. Just go into the kitchen and help yourself. The pistol is well and strongly made, patterned after the style of a regular automatic, measuring five inches in length, just the right size for the pocket; weighs about 6 oz. **Price Postpaid..... 25c** **HOLSTER WITH BELT FOR PEAMATIC, 25c POSTPAID.**

ELECTRIC EYE 25c

DOORS OPEN **BELLS RING** **WINDOW SHUT** The Electric Eye—Photocell—is one of the latest scientific discoveries that has many practical uses. A flash of light opens a garage, window, door, turns lights on or off, stops or starts a motor, etc. Used in all television sets. The miracle with a million uses! No experimenter and no inventor (and who isn't?) should be without this latest scientific novelty. Can also be used to amuse and delight people by creating weird effects. Lights go off, doors bang, with a flash of light. **Electric Eye. Postpaid..... 25c** **Supersensitive Electric Eye, better quality. Price Postpaid..... 50c**

CRYSTAL RADIO 25c

This is a radio in itself as it is possible to get reception with it alone within 25 miles of a station (or up to 100 miles under good conditions). All you need is an aerial and ear phone. Completely assembled & wired with supersensitive crystal, stand, base, crystal cup, arm with cat's whisker, etc. Reception guaranteed. **25c** Single Earphone, 89c. Aerial Kit, 85c.

Electric Baseball Game

Scientific Big League Baseball Pitcher can pitch a 'Slow Ball,' 'Inshoot,' 'Fast Ball' or 'Outshoot.' Batter actually swings a bat! Over 100 possible plays! Strikes, swinging and called. Balls high, wide, low, doubles, triples, home runs, errors, base runner hit by Batted Ball, Out at Home, etc. Scientifically constructed. Completely electric. **Price Postpaid..... \$1.00**

Radio Controlled Model Boat & Plane

Easy to build and fun to operate. Entirely radio controlled. Complete plans..... **25c**

TELEPHONES 10c PAIR

No Batteries Here is a set of phones which carries the voice perfectly for distances from 50 to 100 feet, yet they sell for only 10c a pair! Uses no battery or electricity—just the one connection. Talk from one room to another, from workshop to office, etc. Each phone acts both as a receiver and speaker. Set complete with two phones, transmission cord and instructions. **Price Per Set Only..... 10c**

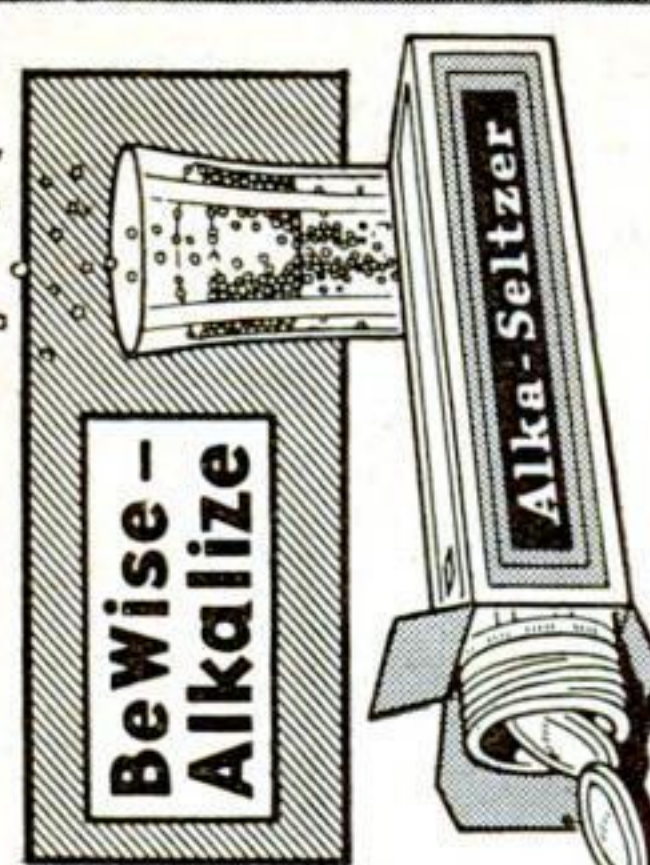
—Send Orders For Goods To—

Johnson Smith & Company, Dept. 248, Detroit, Michigan

☐ Here's 3c for regular edition (DELUXE CLOTH BOUND LIBRARY EDITION, 25c) of your 576 page catalog, 4-color cover, 1¼" thick, 3500 illustrations and 6000 unusual novelties, radios, cameras, scientific novelties, jokes, tricks, etc.

Name _____ Address _____

Send 3c and Coupon for our 576 page Catalog listing over 6000 Novelties.



**Be Wise -
Alkalize**

An Alka-Seltzer
Tablet in a glass of water makes a sparkling pleasant-tasting solution. Drink it and it gives quick relief from Head-aches, Sour Stomach, Distress after meals and other common ailments. It also helps overcome excess acid condition so often associated with these troubles.

TUNE IN
THE NATIONAL
BARN DANCE
SATURDAY NIGHT
NBC • NETWORK

ESPECIALLY
IN THE MORNING,
AFTER THE
NIGHT BEFORE

GREAT STUFF! THAT
ALKA-SELTZER,
TO EASE A HEAD
THAT'S SORE.

MORNING AFTER

A GLASS OF
ALKA-SELTZER,
EXACTLY WHAT
YOU NEED.

I'VE GOT AN
UPSET STOMICK,
GUESS SOMETHIN'
DISAGREED.

UPSET STOMACH

I THINK THAT
ALKA-SELTZER
MUST HAVE DONE
THE TRICK.

I NEVER KNEW
A HEADACHE
TO DISAPPEAR
SO QUICK.

HEADACHE

Alkalize with Alka-Seltzer AT ALL DRUGGISTS

30¢ & 60¢ PKGS.
OR BY THE GLASS
AT DRUG STORE
SODA FOUNTAINS

Radio-Electrical EXPERIMENT KIT

25 pieces genuine commercial apparatus with illustrated manual! Build radio circuits, 110-volt motor, extension phone, thief detector, arc light, arc furnace, electric stove, generate ultra-violet rays, scores more! Used by leading schools!

SAVE 60%. Send only \$3.99 for kit and 6 Radio-Electrical books (value over \$10.) Or, sent C. O. D. Money back if not 100% pleased. 3c stamp brings Bargain Catalog!

ELECTRICAL SALVAGE CO. Box 524-88 Lincoln, Nebr.

Only
\$3.99
6 Books FREE



POPULAR SCIENCE

Question Bee

HERE are the answers to the Question Bee on page 152. In the list below, the letter alongside each number indicates the correct solution to the corresponding numbered question. Check your results against this list and give yourself five points for every one you had right. A total score of 75 to 85 is good, and 90 to 100 is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. d | 5. c | 9. d | 13. b | 17. c |
| 2. c | 6. b | 10. c | 14. a | 18. c |
| 3. b | 7. d | 11. b | 15. b | 19. c |
| 4. d | 8. b | 12. a | 16. d | 20. e |

New Beams for Buildings Made of Laminated Wood

WOODEN boards and beams possessing any desired combination of qualities, with as much uniformity as steel or other metals, can now be produced by a modern adaptation of the familiar process of veneering. Over a core made of some less desirable material, laminated layers of various woods are glued in proportions designed to supply the qualities required in the finished product. In this way, a building material of a given density, elastic strength, and other properties can be created at will, and produced in large quantities with absolute uniformity. In gluing the layers together, heat and pressure are used as in ordinary veneering. The adhesive employed is a resin containing phenol, and is said to make the boards and beams fungusproof, an important consideration in building materials.

Barrel-Type Motor Has Crankless Crankshaft

RADICAL in design, a new type of airplane engine has its cylinders parallel to the crankshaft on which the propeller is mounted, instead of at right angles, as in conventional gasoline engines. Called a "barrel" engine by its developers, it is exceptionally small. Within its diameter of fifteen and a half inches, it packs four cylinders that develop 115 horsepower at 2,000 revolutions a minute. It has no "cranks," employing instead "wobble plates," curving fins attached to the crankshaft, which are pushed by special piston rods to transmit the power developed in the cylinders. The engine is credited with great fuel economy, and weighs slightly over two pounds for each horsepower. Later models are expected to reduce this ratio considerably.

Can You Equal This Home for 837

Shipped
Direct
from Our
Mill



Save 30% to 40%
on Your New Home..

**WE PAY
FREIGHT**

Don't pay several hundred dollars more than necessary when you build a home! Buy it direct from our mill at our low factory price. We ship you the materials—lumber cut-to-fit, ready to erect. Paint, glass, hardware, nails, etc., all included in the price—no extra charges. We pay the freight. Plans furnished—also complete building instructions. No wonder our customers write us that we saved them 30% to 40%, compared with builders' prices. Easy terms—monthly payments.

Send for
**FREE
BOOK**
of Liberty
Homes

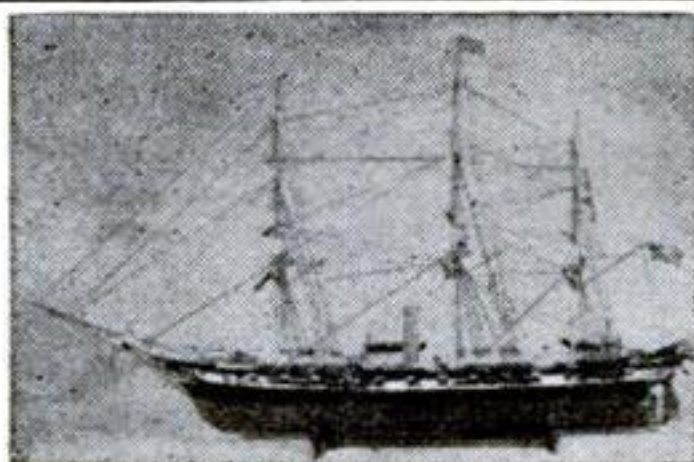
**Handsome Big
CATALOGUE FREE**

Pictures wonderful homes in colors at money-saving prices. Designs to suit everyone. Write for your catalogue today!

LEWIS MANUFACTURING CO.
Dept. 13810 Bay City, Michigan

SHIP MODELS

The quick and easy road to ship modeling is to get one of our accurate scale construction sets. With them you can concentrate on the interesting part of the model. Similar sets for models of Flying Cloud, Destroyer Preston, Constitution, U. S. S. Texas, Whaler Wanderer and many others. Also semi-finished hulls and all sorts of materials and fittings such as blocks, deadeyes, anchors, steering wheels, guns, lifeboats, etc. Large 64-page photographically illustrated booklet, describing the above sent postpaid upon receipt of 15c (coin). Many persons on receiving this booklet, have discovered how simple and enjoyable is ship model making. Be sure to get your booklet before starting your model.



Model Ship Supply Co. Dept. P Mineola, N. Y.

CUT ME OUT

Cut me out, paste me on a postcard and mail to Popular Science Monthly, Dept. 108, 353 Fourth Ave., New York, N. Y. I'll bring you complete supplies and instructions on how to make easily several dollars a week in your spare time.



MULTI-USE RULE and GAUGE
PRICE \$1.00

This handy, compact, precision built tool is made of stainless steel. Note these time saving features: 4" quick reading scale; Drill point gauge; square; center finder; circle divider; tap drill table.

FREE: A genuine leather case given away with every Multi-use Rule.

Send for your **FREE** illustrated wholesale tool booklet.

Homecraft Tool Supply Co.
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**1001
PHOTO VALUES
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WHOLESALE RADIO SERVICE CO., INC.
109 SIXTH AVENUE • NEW YORK, N. Y.



Send a Dime

FOR THIS AMAZING NEW
"STICKER" AND "MENDER"

and save \$\$\$

WITH CARTER'S CARTEX

Spreads like cold cream... sticks like cement. **WATERPROOF**, it can be used for patching tents, raincoats and sails, etc. **ELASTIC**, it will even stop squeaks in cars. **PERMANENT**, it stays stuck. **CLEAN**, it rubs right off your hands. **VERSATILE**, it mends or patches pants, rugs, shoes, bats, cloth, paper, cardboard... so many uses we can't begin to

list them. **BRAND-NEW**, your dealer may not have it yet. If not, send a dime today and get a large tube of Carter's Cartex and helpful instruction folder.



THE CARTER'S INK CO.
Dept. D-1, Cambridge, Mass.

Enclosed find dime (or 10¢ in stamps) for large tube of Carter's Cartex and helpful instruction folder.

Name _____

Street _____

City _____ State _____

BARGAINS—NEW & USED

Standard microscopes and accessories. Photo-micrographic, petrographic, metallurgical and polarizing instruments. Binoculars, telescopes, cameras, optical apparatus and lenses. Chemical laboratory apparatus, testing and research equipment. Practical scientific novelties. Catalog 10 cents.

HARRY ROSS SCIENTIFIC AND LABORATORY APPARATUS
82-84 WEST BROADWAY, NEW YORK, N. Y.

Don't PULL HAIR FROM NOSE!
May cause fatal infection

use **KLIPETTE**
NEW INVENTION

You can cause serious infection as a result of pulling hair from nose. Use of scissors is also dangerous and impractical. There is no better way to remove hair from nose than with *Klipette*, ingenious new invention. Works on clipper principle—smooth, gentle, safe and efficient. Cannot cut the skin.



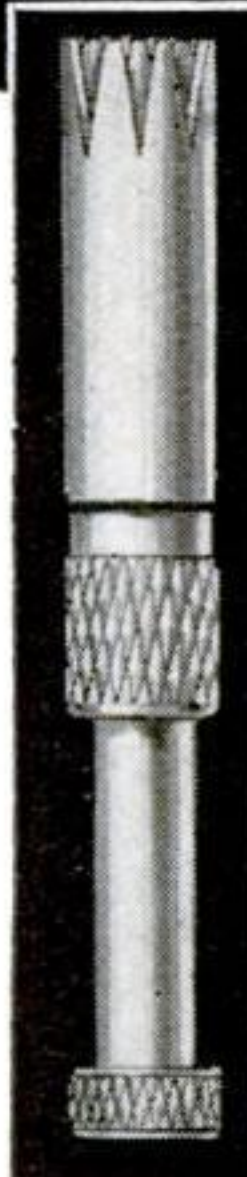
SO SIMPLE! Just insert into nostril and revolve cylinder. Surplus hair comes out easily and gently. Never pulls.

Guaranteed to Satisfy or money back.

HOLLIS CO., 207 Market St., Newark, N. J., Dept. 116
Enclosed is \$1 for KLIPETTE. If not entirely satisfied, I may return it and \$1 will be refunded.

Name _____

Address _____

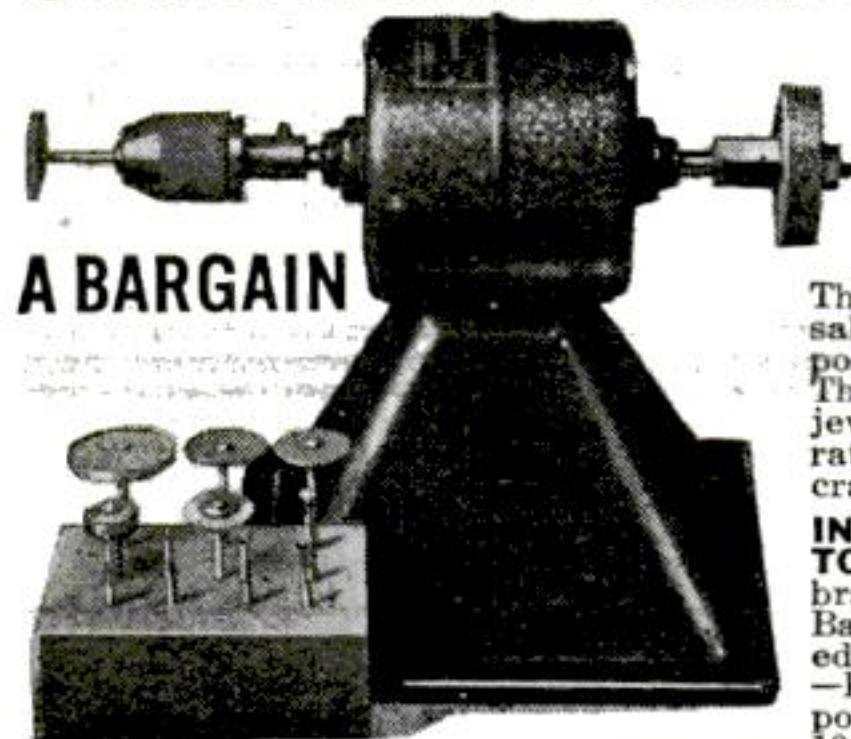


\$1.00

Made from finest Surgical Steel, Chromium plated.

UNIVERSAL GRINDER \$3⁹⁵

Complete



A BARGAIN

INCLUDES 30 PIECE ARBOR SET

The grinder that is truly universal in its application to jobs impossible with other power tools. This versatile tool is needed by jeweler, optician, dentist, laboratory, model maker and home craftsman.

INCLUDES 30 PIECE ARBOR TOOL SET: 9—Grind stones with brass centers assorted sizes. 2—Bakelite cut off wheels. 3—Assorted engraving or carving burrs. 2—Polishing buffs. 1—Mounted point. 1—Bristle polishing brush. 10—Assorted sanding discs emery, sand, garnet, fine, coarse and medium. 2—Screw Mandrels. 1—Large grind stone.

LOOK AT THESE AMAZING FEATURES

Dynamically balanced hi-speed motor with heavy cast removable base. Self aligning bearing semi-oilless and oil reservoir in each bearing. Tool steel motor shafts. Compact design enables you to work on delicate jobs. Equipped with a three jaw universal arbor chuck, adjustable to take fine drills. Arbor tool set enables you to grind, drill, rout, carve, sand or polish. Operates on 110 volt A. C. or D. C. **Variable Speeds** 10,000 R. P. M. to 500 R. P. M. with use of rheostat \$2.50 additional.

Rush \$1.00. Balance C. O. D.

PHILA. MACH. CO., (Dept. AS), 118 N. SIXTH ST., PHILA., PA.



50 PIECE UNIVERSAL ARBOR TOOL SET 95c

Indispensable to Jeweler, Laboratory, Model Maker and Home Craftsman. The ideal outfit for fine accurate grinding, sanding, routing or carving. Includes 12 grindstones with brass centers in assorted sizes, 5 bakelite cut-off wheels, 5 assorted engraving, routing or carving burrs, 2 polishing buffs, 1 mounted point, 2 bristle polishing brushes, circular and cup shape, 3 mandrel arbors, 20 assorted sanding discs of emery, garnet, sand, fine, medium and coarse.

Send Coin or Money Order
Shipment Prepaid

PHILADELPHIA MACHINERY CO. 118 N. 6th ST., PHILA., PA.

NEW BENJAMIN AIR PISTOLS WITH LEVER HAND PUMP



ASK
FOR FREE
TARGETS!

Now You Can Use Benjamin Genuine Compressed Air Pistols With New Multiple Lever Hand Pump Anywhere—Indoors & Outdoors—for Target Hunting—Camping, etc. No noise—smoke or fumes. Adjustable Force with Amazing Maximum Velocity. Bolt Action—Hammer Fire—Hair Trigger—Safety. **Guaranteed—Economical—Practical—Accurate—Safe.** Single Shot BB Air Pistol with smooth barrel \$8.50; cal. 177 or 22 Single Shot Air Pistols with rifled barrel \$8.50; BB 8-Shot Air Pistol with smooth barrel \$10.00; Holster \$2.00. We also make a complete line of Benjamin Genuine Compressed Air Rifles for BB and cal. 177 or 22 pellets and darts. No license required to purchase from dealer or prepaid from factory. Write Today for Complete Specifications. Benjamin Air Rifle Co., 852 Marion St., St. Louis Mo.

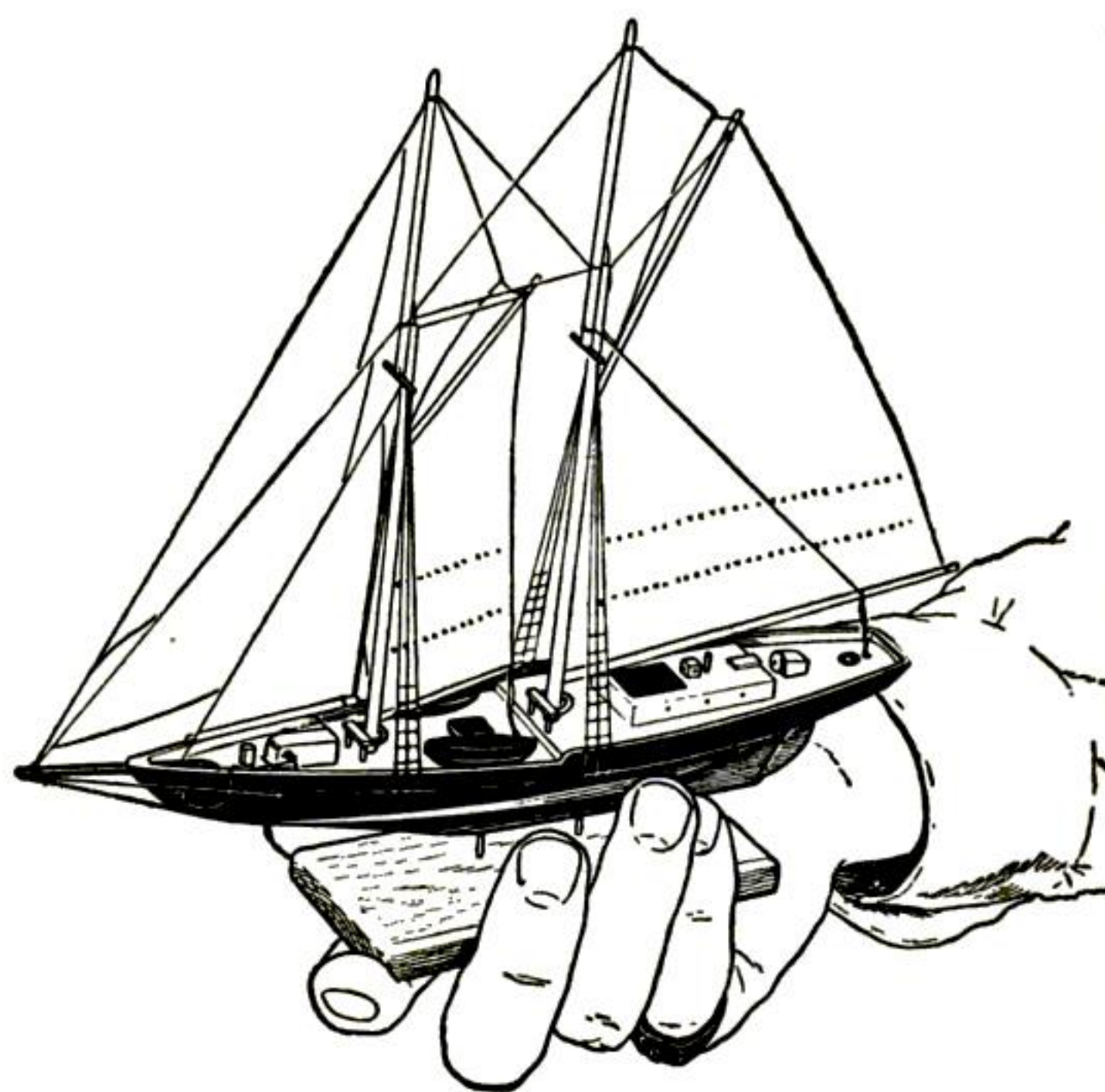
NO FRIENDS SINCE PIMPLES CAME?

Get this help in guarding against skin-blotching intestinal poisons

Are ugly skin eruptions spoiling your good times . . . making others shun you? Find out what the trouble may be—and take steps to help it.

Between the ages of 13 and 25, or even longer, important gland changes often upset the system. The skin often becomes over-sensitive. Waste poisons from the intestinal tract may get into the blood stream . . . and be carried to the skin to cause disfiguring pimples.

Many have been helped by the regular use of Fleischmann's Yeast. Millions of tiny, live plants in each cake of this fresh food act to help keep intestinal waste poisons from the blood . . . and so help your broken-out skin. Start eating Fleischmann's Yeast now—one cake ½ hour before meals. Buy some today!



Miniature Schooner Added to Our CONSTRUCTION KITS

WHETHER you are a beginner or an advanced model maker, you will get a thrill out of building the newest ship in our Model-of-the-Month series. It is the *We're Here*, a 9½" long replica of the fishing schooner in Rudyard Kipling's book *Captains Courageous*.

For the convenience of readers we have prepared a kit containing all the raw materials you need for making this miniature schooner. The construction is so simple that you should experience no difficulty. The kit, including a full-size blueprint, costs only 75 cents.

Many other kits are available also. A complete list is given below.

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5M. Liner <i>President Lincoln</i> , 14¾" long.....	1.50
6M. Fishing Schooner <i>We're Here of Captains Courageous</i> , 9½" over all.....	.75

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(Continued on page 256)

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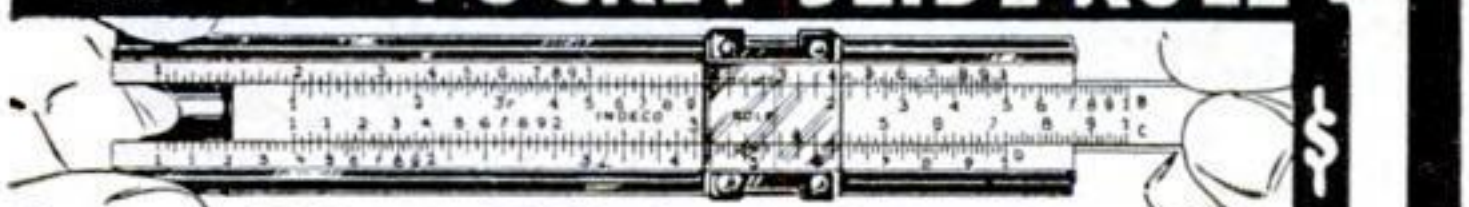
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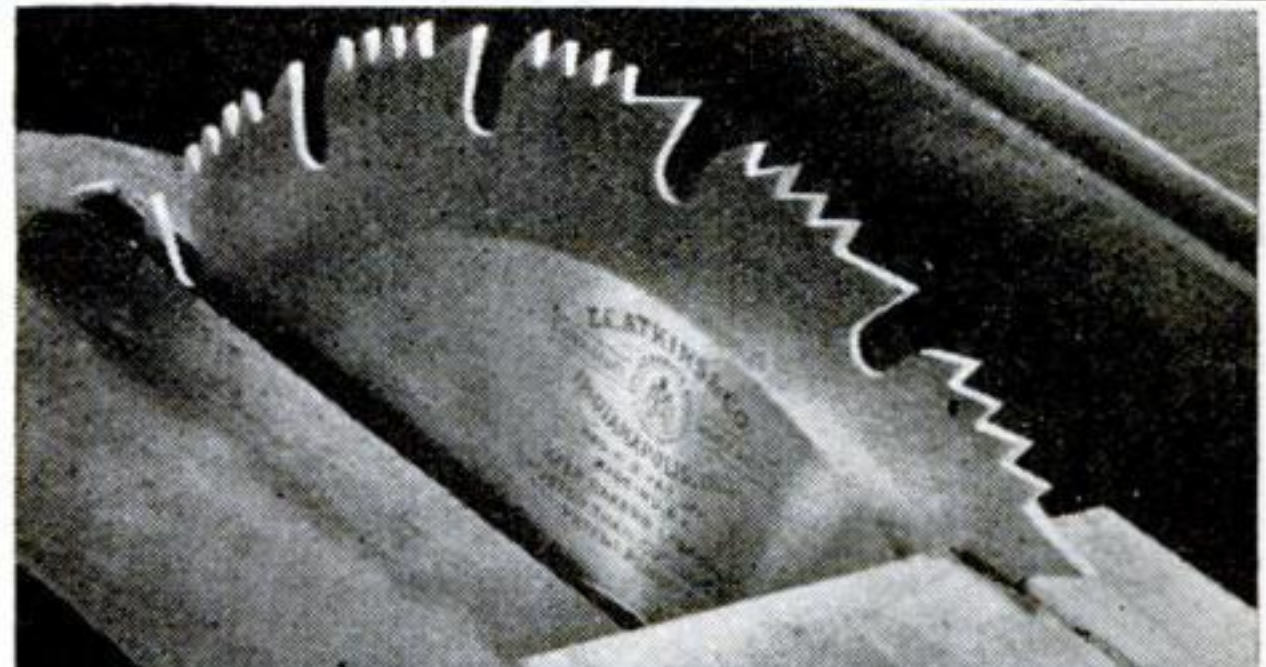
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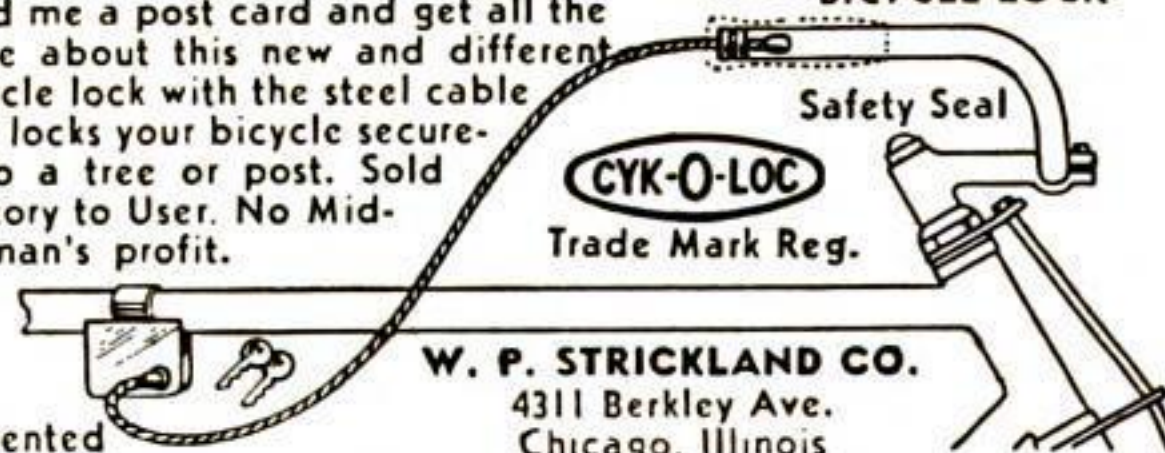
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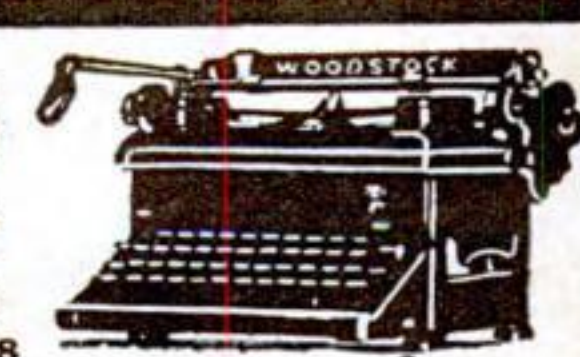
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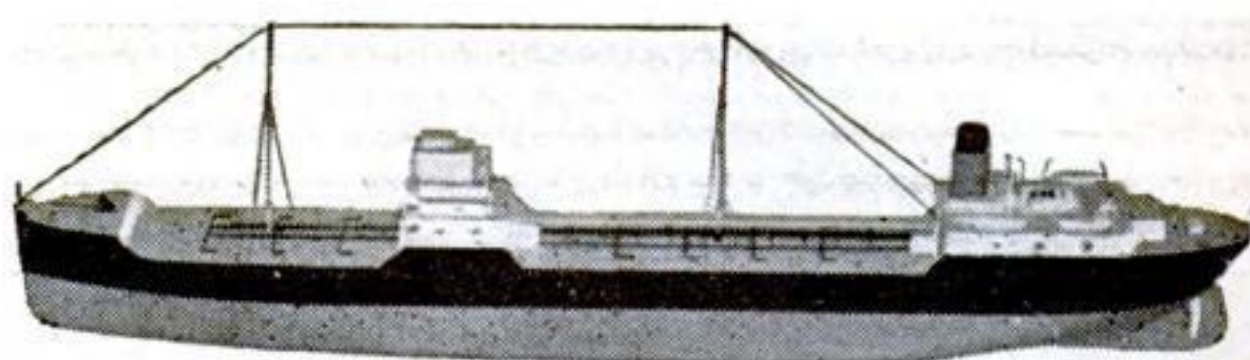
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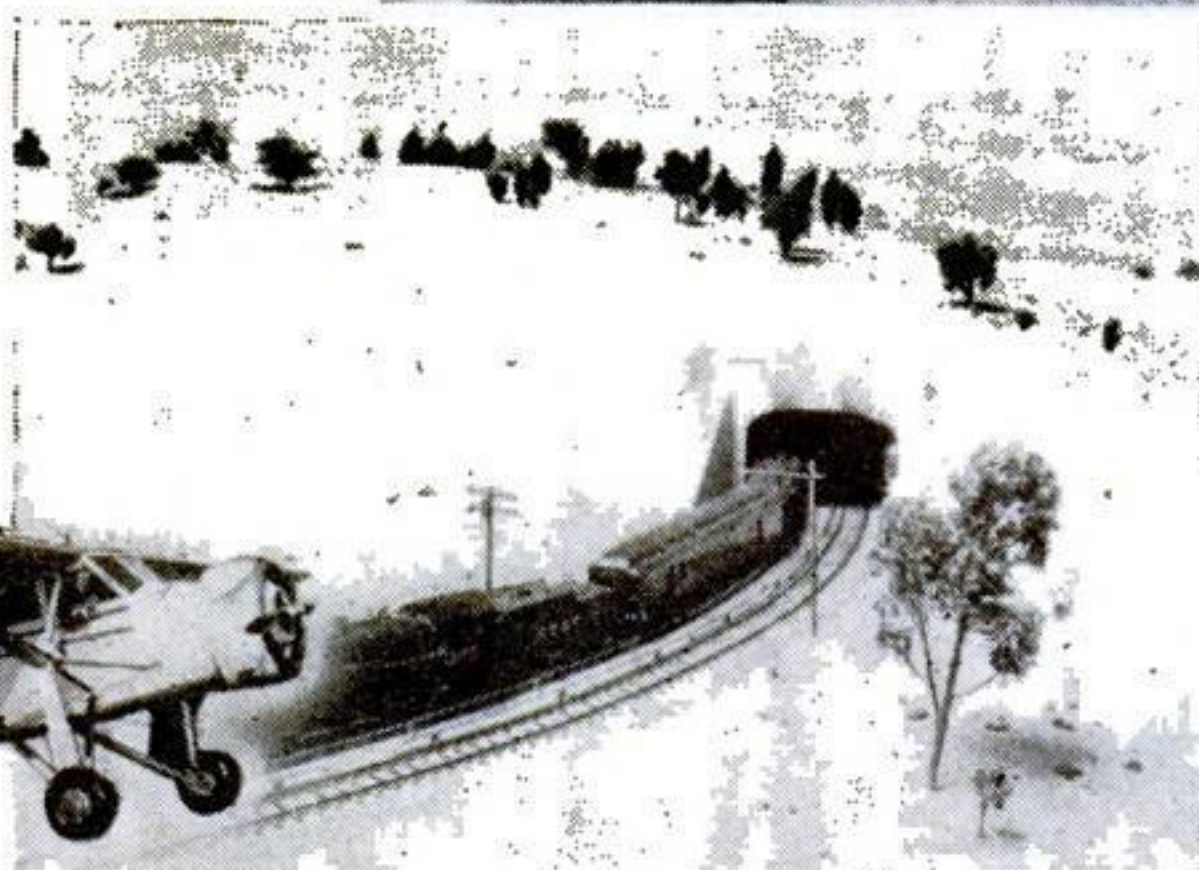
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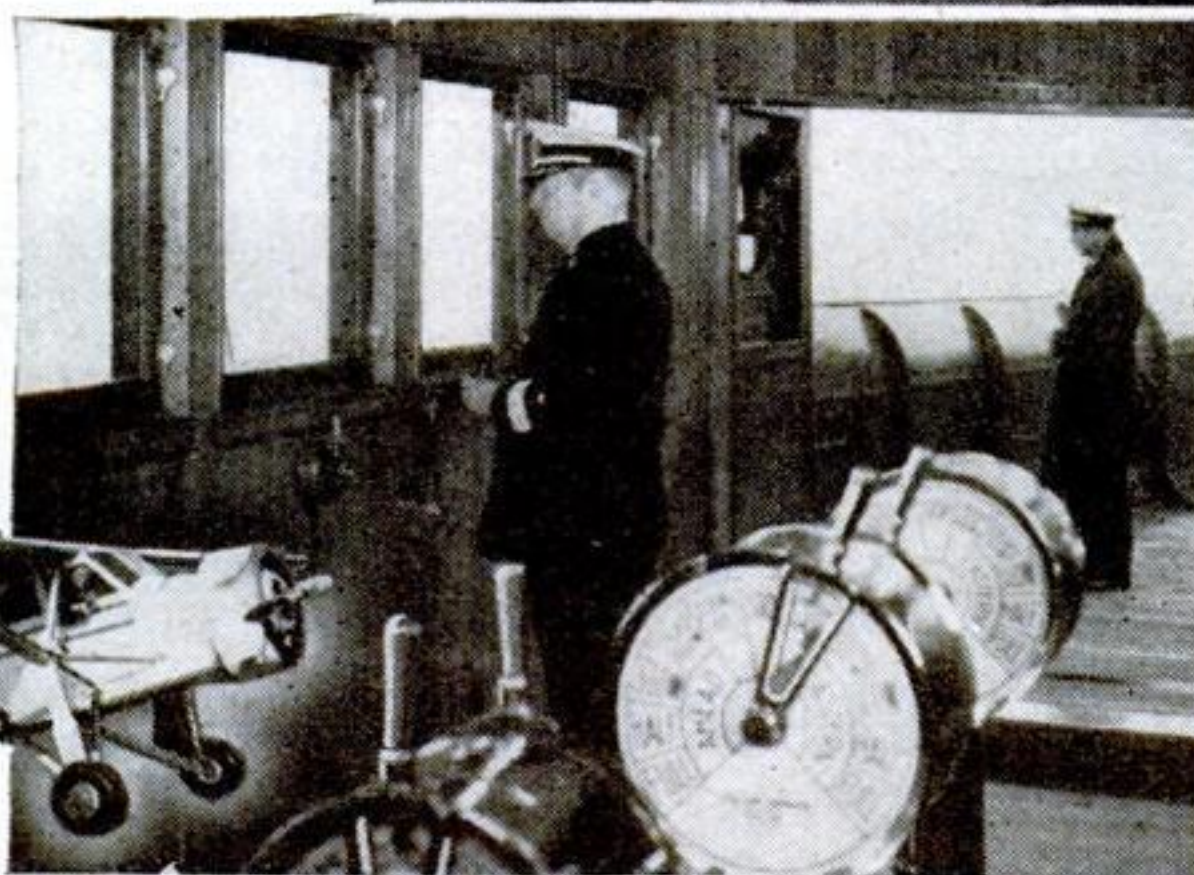
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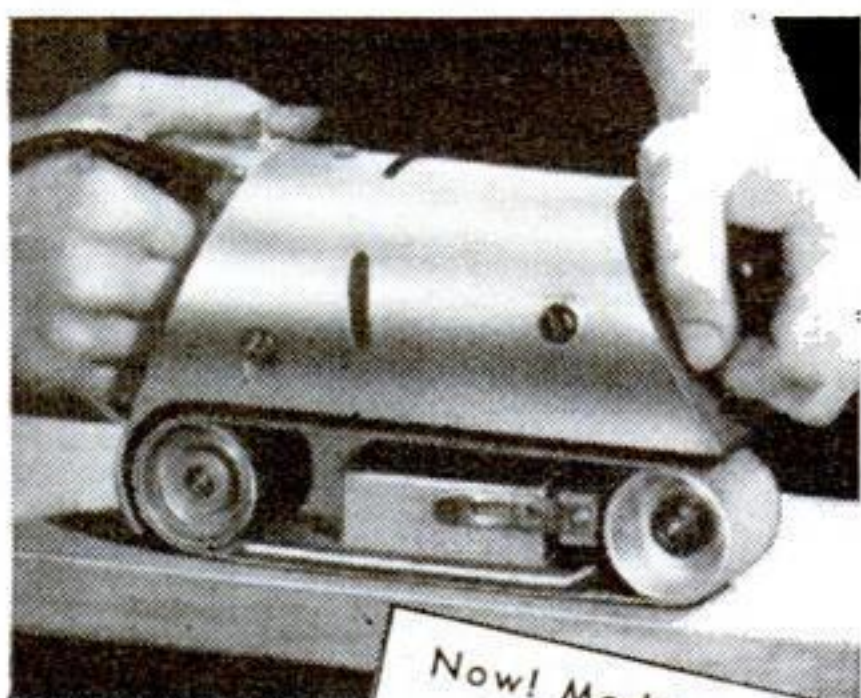
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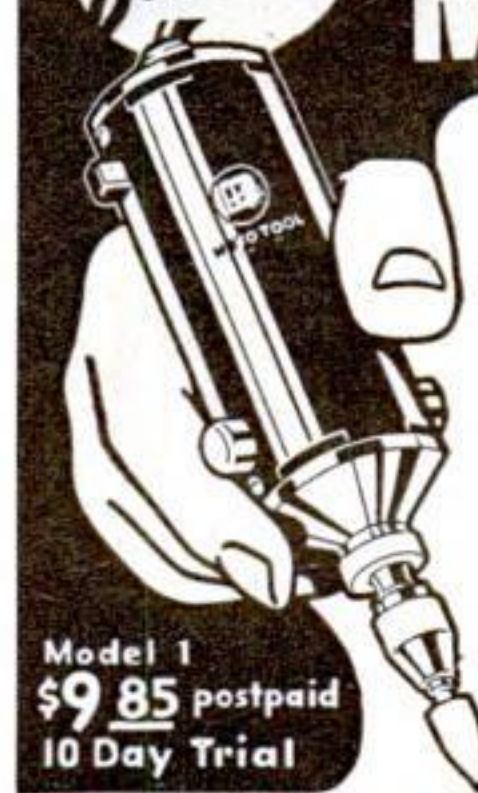
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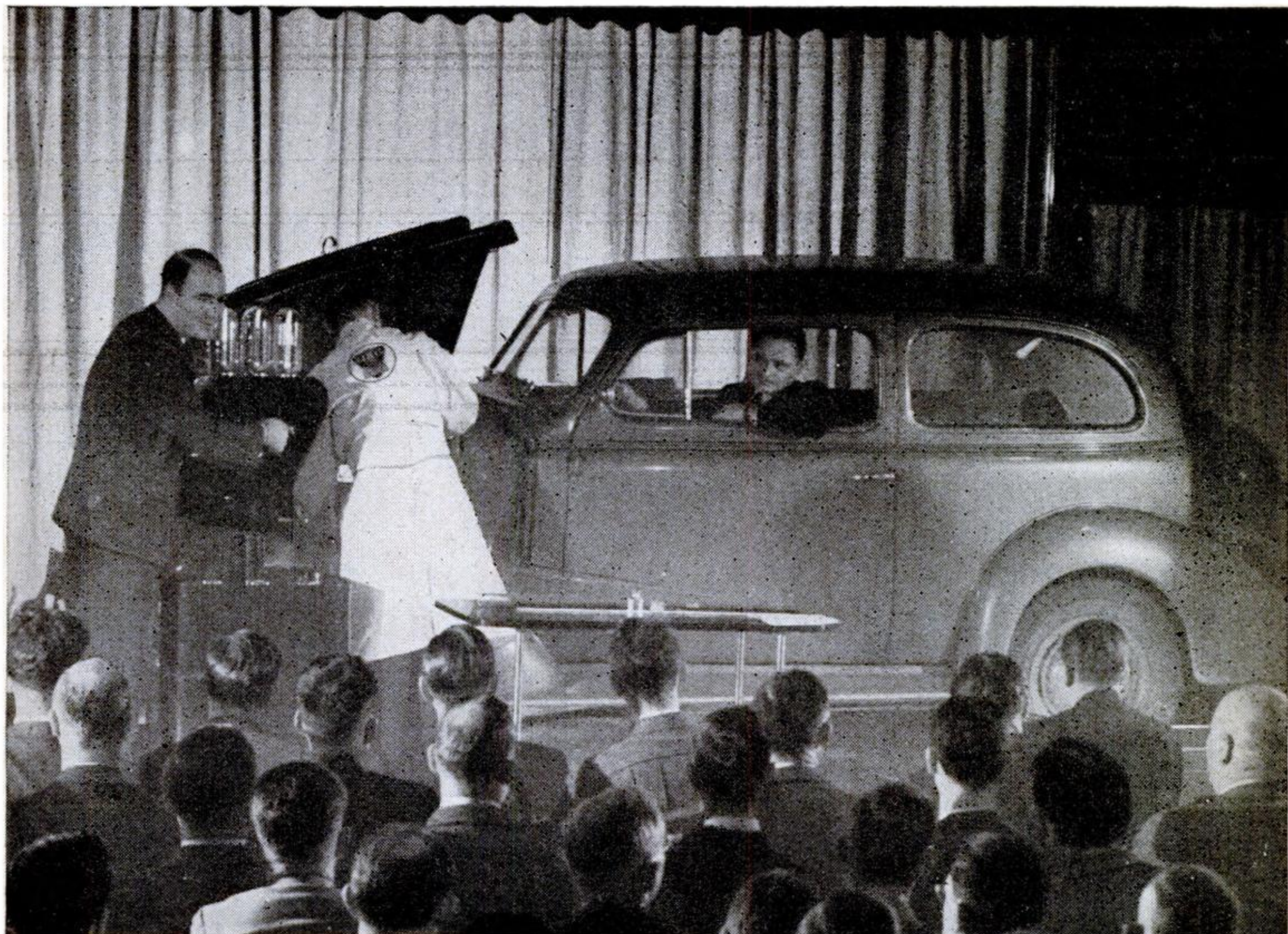
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THEY CAME AND SAW. At the Ethyl Motor Clinic popular makes of cars were run on the three grades of gasoline sold today. The entire audience *saw* the results projected on a large screen. This test, and others, definitely proved that modern cars have three grades of performance.

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with "low-grade" gasoline



There is no anti-knock fluid (containing tetraethyl lead) in "low grade" gasoline. Power is lost because the spark *must* be retarded by your car dealer to prevent "knock" or "ping."

Good performance

with "regular" gasoline



Most regular gasoline has in it anti-knock fluid (containing tetraethyl lead). The spark can be considerably advanced for more power without "knock" or "ping."

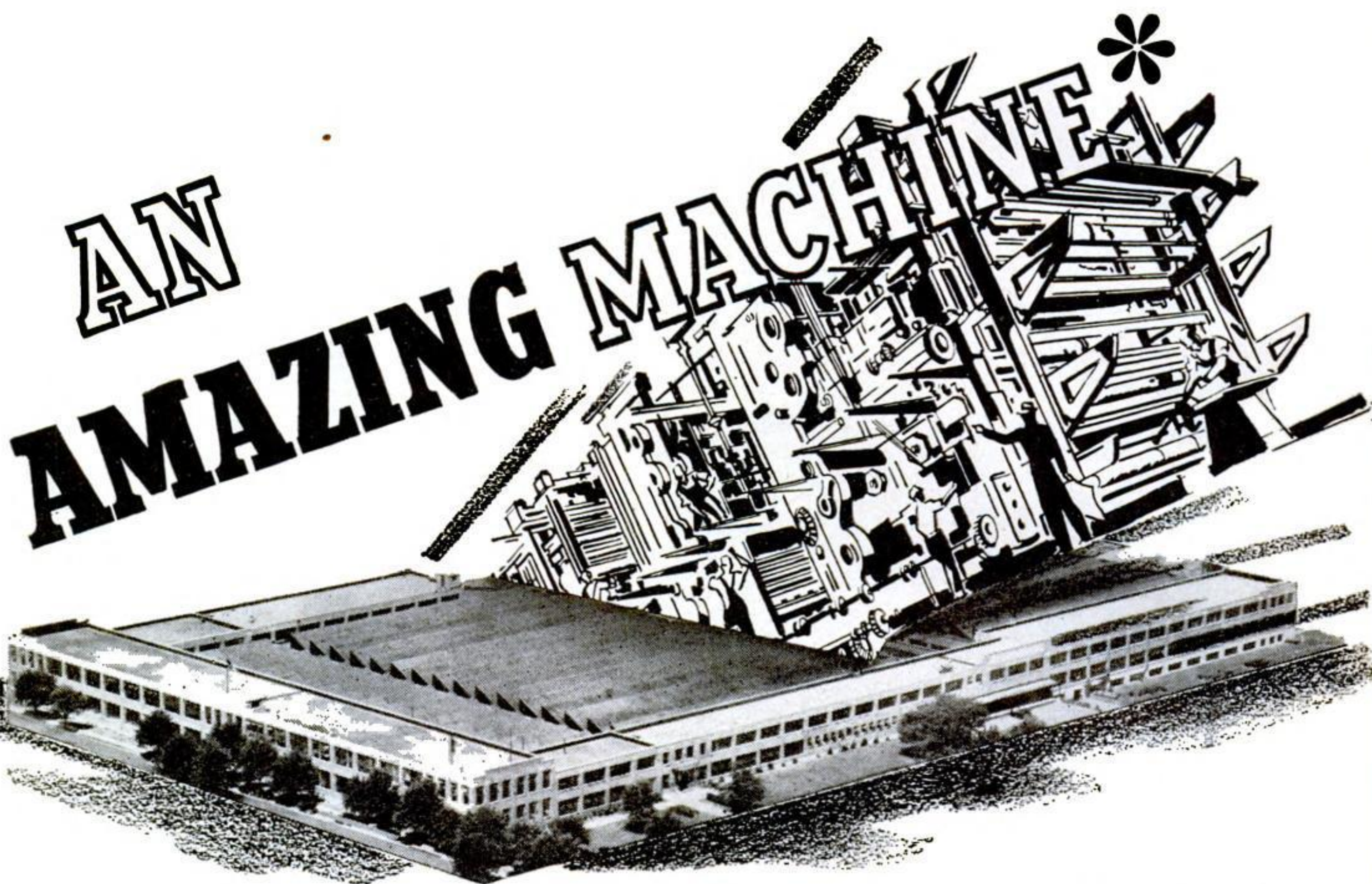
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with gasoline containing "ETHYL"



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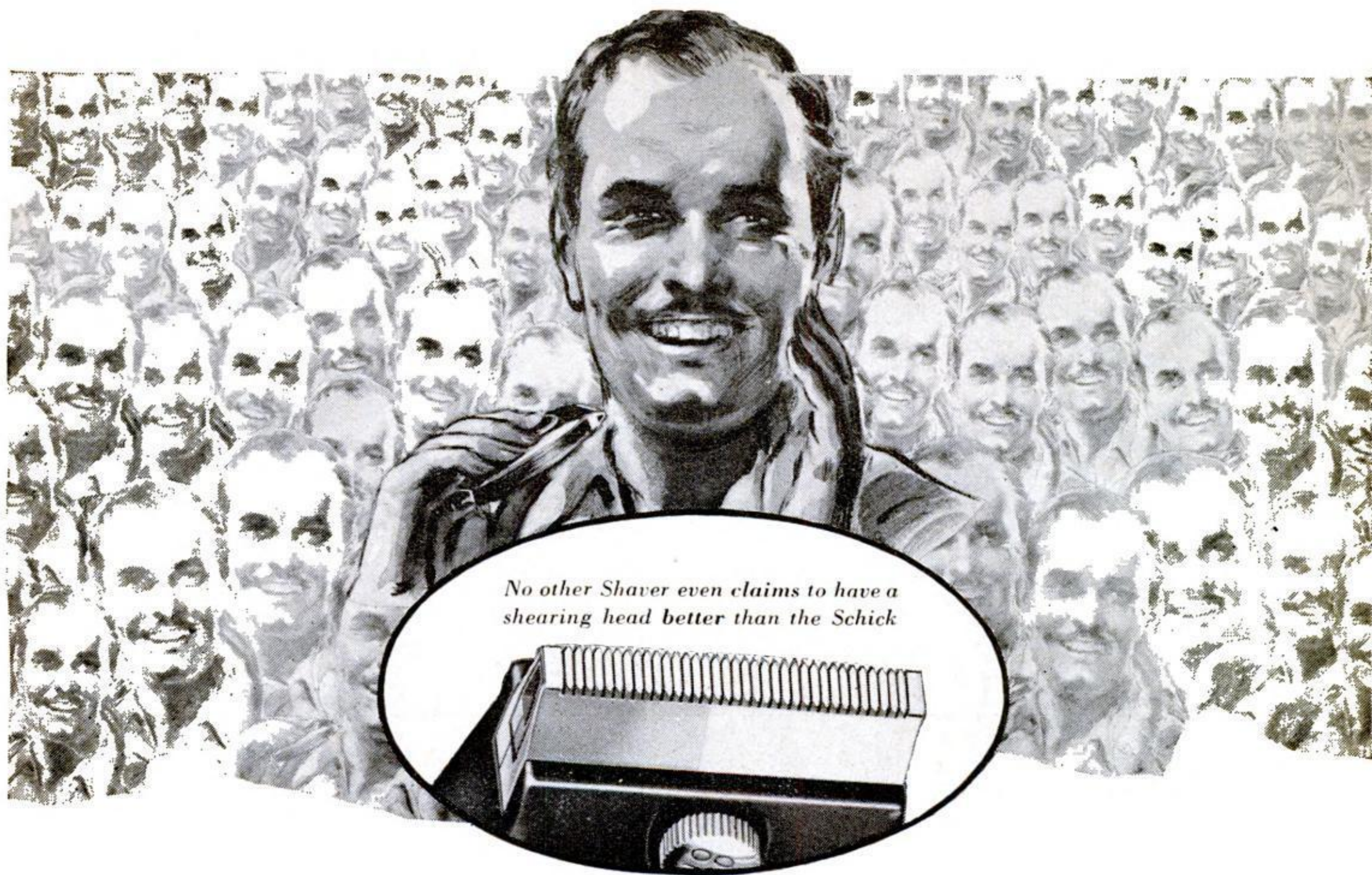
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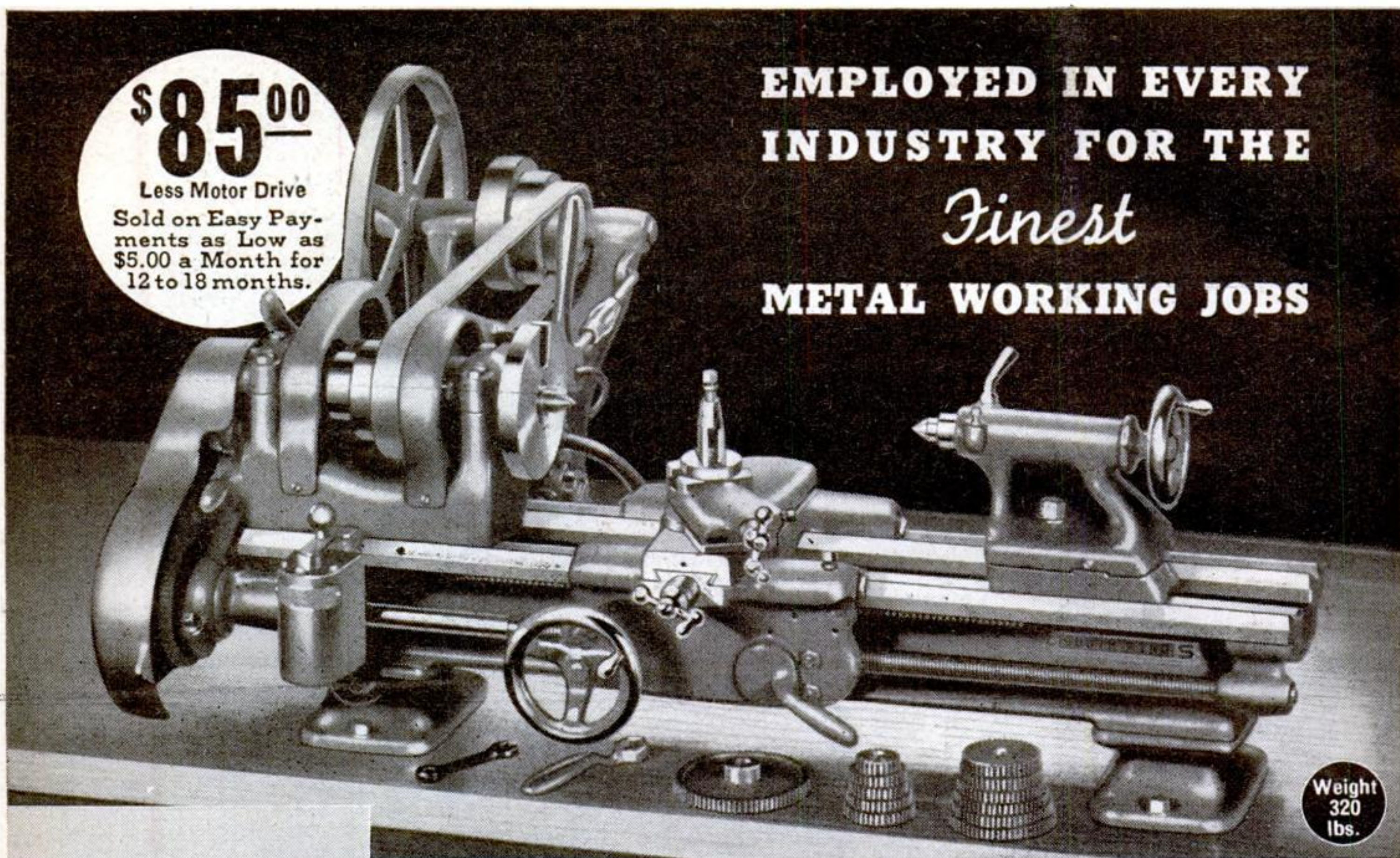
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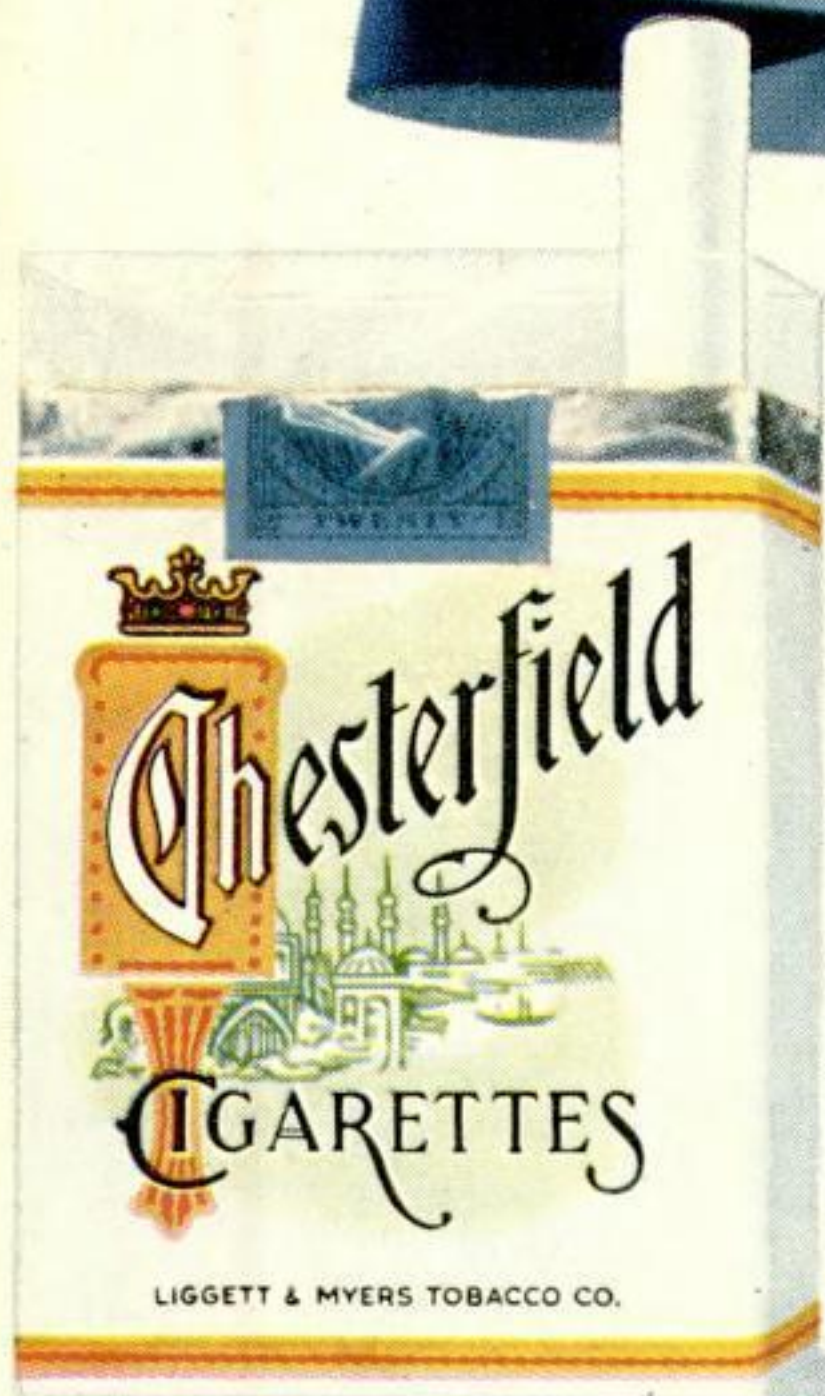
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